Concrete

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Cheaper Distribution

> *Investigation into the problems confronting industry today develops the fact that, through pressure brought about during the war and the boom period following, industrial organizations had built up their plants and technical departments to a high degree of efficiency. When depression came, the pressure of competition forced these same organizations to reduce production costs, but the distributive agencies seem to have been neglected. As a result, we have today too wide a spread between the cost of an article at the producing point and the cost to the consumer. This is unquestionably due to inefficiency and waste in selling and our big problem today, therefore, is elimination of waste in distribution. No individual can prescribe a cure which will fit all industries for each one has its own particular problem.*—Secretary of Commerce Herbert Hoover, in a message to the National Industrial Advertisers Association.

THE builder feels the necessity before this country for the elimination of waste in distribution.

A retail dealer in lumber, for instance, ventures the opinion that the "spread" between producer and consumer is a problem to which the retail dealer must apply his best intelligence. He spoke at the recent retail lumbermen's convention at Atlantic City, and while he is a comparatively young man, recalled the days when to add $2.50 per thousand feet covered the retail dealers' handling costs. Now he finds it necessary to add five times that amount to cover his costs alone, so that $32 lumber becomes $50 lumber and higher to make business only fairly profitable.

These conditions affect building and builders. The instance quoted above may be extreme but the retailers are thoroughly alive to the problem. Standardized cost accounting is making rapid progress and with a thorough knowledge of costs which many dealers haven't had until lately, steps are invariably taken to reduce those costs. Another important partial solution is in cooperation among dealers in the maintenance of yards and warehouses where stocks in certain lines of materials are maintained for all the dealers, avoiding the excessive warehousing and carrying charges which are necessitated by a dozen stocks in the yards of as many dealers.

Some contractors think they can beat the game by buying direct from producers. Some very large operators probably do save money this way but when they want something in a hurry they go to the dealer. The economic solution does not seem to be in increasing the number of small local stocks by making every contractor run his own lumber and material yard but rather in such greater concentration of dealer stocks and service as will supply in volume of business a satisfactory profit from smaller margins and effect economies in handling by vastly increasing the quantities handled through any one establishment.

It is something the distributors are pondering and as the contractors are their customers and have to foot the bill it may be that the weight of contractor opinion in favor of more concentrated handling of materials would help the dealer to bold steps to give the public more economical service.

* * *

A Good Workman

EVERY fine piece of work—a concrete road without rough pockets or ripples, a sidewalk that wears evenly and slowly to the rich mosaic of its aggregate, a wall where the removal of forms reveals no streaks or honeycomb, a stucco surface that is a constant delight in its texture and color—all these achievements that show us the application of concrete at its best, are traceable to men who know more than the specifications can tell.

It is this fact which compels an admiration of that human factor of workmanship which is too elusive to be captured in a line or two of type.

Year after year we make some progress in our knowledge of how to do things. Committees in our technical societies with great labor evolve "specifications" and "recommended practices." They do a vast amount of good; they raise the general average; but they are always based on minimum and not maximum excellence. They invariably state the least that is acceptable. They are invariably a compromise between that excellence which the best workmen are able to achieve and that lesser excellence we are willing to accept from the average workman.

So when a job excels it is *the man* who did it—not the specification.

Men who know their materials and their tools are at the bottom of all the rules by which apprentices must learn. The craft is first—the specification is second.

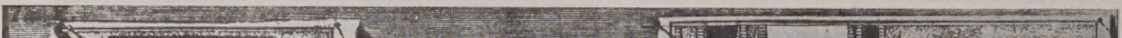
Men learned how to write before rhetorics could be written. Men learned how to wield a trowel before a floor finish specification could be drawn up.

It is this that weaves the romance of craft. We are reminded in a letter from a great artist with concrete that: "Craftsmen are the greatest force in the arts. Scientists may improve an art but almost without exception all arts have been established by craftsmen. Craftsmen built the baths of Caracula, St. Peter's Church and Notre Dame before engineers were able to express the problems involved. The successors to such men are equally as able and as worthy of applause."

That is why a good job of concrete, something that exceeds the requirements of the specifications, inspires admiration for the man who knows more than the books can tell.

THE EGYPTIAN PICTURE SHOWS HOW A CEMENT MIXTURE WAS USED AROUND THE PILLARS OF THE TEMPLE AT KARNAK IN ORDER TO GIVE A MORE PERFECT SURFACE FOR THE HIEROGLYPHICS. IT WAS ALSO USED AS A FILLING FOR THE CENTER OF OTHER STONE PILLARS. THIS CEMENT WAS NON-WATERPROOF, BUT WATERPROOF CEMENT WAS NOT REQUIRED AS IT RAINED ONLY ABOUT ONCE A YEAR IN EGYPT.

THE ROMAN PICTURE BELOW REPRESENTS SECTIONS OF THE WATER DISTRIBUTING RESERVOIR OF JULIA OF ROME, BUILT AT THE BEGINNING OF THE CHRISTIAN ERA. MOST OF THE WALLS AND THE PARTITIONS OF THIS RESERVOIR WERE OF CONCRETE, AND WHERE IN CONTACT WITH WATER WERE OFTEN LINED WITH AN EXTRA LAYER OF CEMENT. THIS WAS WATERPROOF, AND WAS MADE FROM THE POZZOLANA, OR STONE BURNED BY VOLCANIC ACTION. A CHARACTERISTIC FEATURE OF ROMAN ARCHITECTURE, IN WHICH GREAT SPACES WERE COVERED WITH VAULTS AND DOMES, WAS POSSIBLE BY CASTING THEM IN SEMI-FLUID CONCRETE MIXTURES.



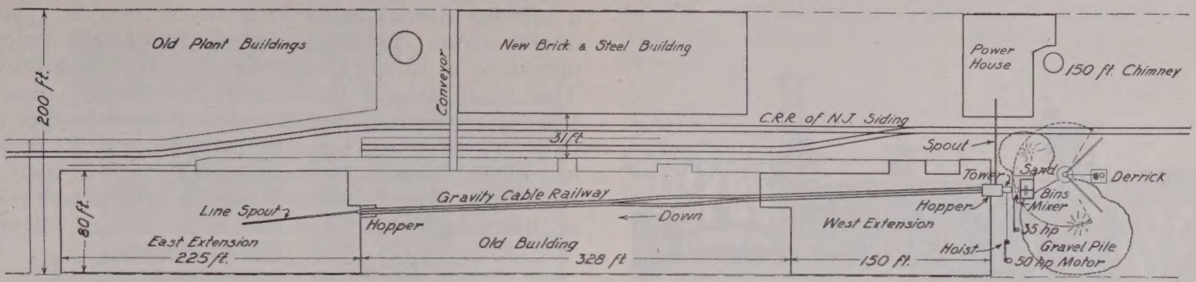


FIG. 1—DIAGRAM SHOWING THE GENERAL LAYOUT OF THE PROPERTY AND THE LOCATION OF THE NEW EXTENSIONS WITH REFERENCE TO THE ORIGINAL BUILDINGS, INTERNATIONAL MOTOR CO., PLAINFIELD, N. J.

Concreting Under Restricted Conditions

BY WILLIAM WREN HAY
MEMBER AMERICAN CONCRETE INSTITUTE

The Plainfield plant of the International Motor Co., makers of Mack trucks, occupies a long, narrow, plot of ground, 200 ft. wide by over 1600 ft. long, lying between the main line tracks of the Central R. R., of New Jersey, and a highway with heavy traffic. This situation has led to many difficulties during the construction of new additions, particularly in handling concrete to place. The additions are extensions to both ends of the four-story reinforced concrete building built in 1918, as well as a brick and steel structure parallel to this and a small power house opposite to one extension. The location of these structures restricted all movements of materials from the receiving end of the yard to a narrow strip between the buildings, 31 ft. clear, traversed by two factory siding tracks at different levels. The problem of conveying concrete to the more easterly extension, surrounded on three sides by old buildings and on the fourth side by the highway, was successfully solved by the very unusual expedient of conveying concrete over the roof of buildings and down to the new floor slabs.

The reinforced concrete extensions east and west from the existing buildings are, respectively, 225 ft. and 175 ft. long, by about 80 ft. wide, four stories high, the construction being flat slab design to conform to the existing structure. The only open storage space available for construction purposes was in the westerly yard, and concrete materials were unloaded and the concrete mixing plant set up at the west end of the structures, cars being received alongside. All aggregate was received in gondolas and unloaded by a stiff-leg derrick with clamshell bucket, either to storage piles behind the mixer or, when concreting, direct into the small charging bins over the mixer. A timber hoist tower was erected against the end of the west extension as soon as the pile driver was off the site, driving piles for the east extension. Upon completion of the west building, a timber trestle was erected across the roof of the new structure and of the old building, and concrete was conveyed to a roof hopper for spouting to the east extension.

This trestle was about 470 ft. long, and only three rails were laid for two-way operation, a single passing point with four rails laid about midway of the length permitting the operation of two cars. There was a total fall of about 7 ft. from the tower hopper to the chute hopper, with accelerating starting grades, and all movement was by gravity, the 1½—cu. yd. side dump, V-bottom, roller-bearing cars[1] being coupled by a small wire rope so that the full car running down grade drew the empty car and operator back to the tower hopper. The operation of this balanced car system was very

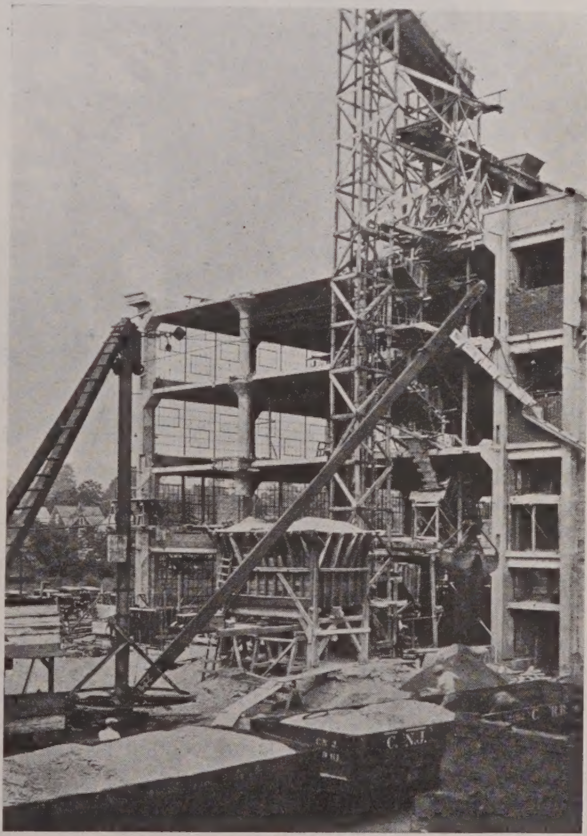


FIG. 2—DERRICK, CONCRETE MIXER PLANT AND TOWER

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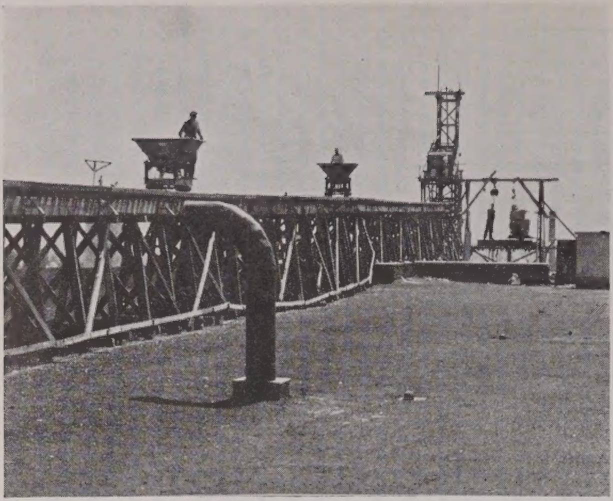
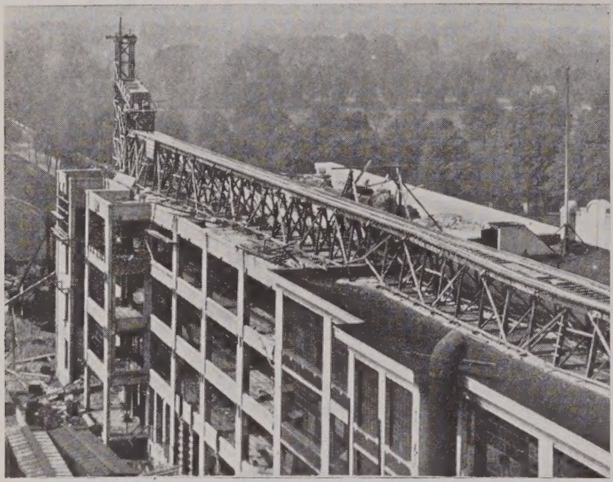
[1] Easton Car & Foundry Co., Easton, Pa.





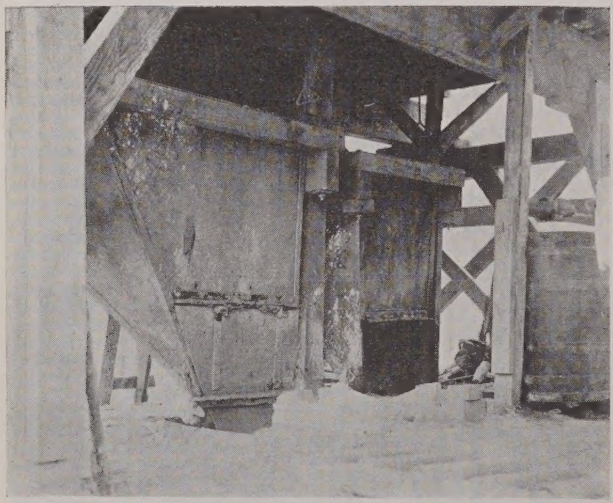


Fig. 3—View of Trestle across Roof

Fig. 4—View of Balanced Cable Car Tracks on Roof of Buildings

Fig. 5—Balancing Weigh Hoppers over Concrete Mixer Hopper

successful when each car was loaded with about 1.2 batches, as the speed and capacity was then nicely synchronized with the other operations. The cars were charged by bin gates over each track from the tower hopper and dumped into a large wooden roof hopper, from which the concrete was chuted to a wooden floor hopper, and thence conveyed to place in the forms by ordinary concrete carts. Observations made show that each car made the round trip in about four and a half minutes, and traveled at a speed of 380 ft. per min.

The unloading plant, as was mentioned above, was a stiff-leg derrick with Lidgerwood double cylinder, double drum, hoisting engine[2] and Drake swinger[3], operating a ¾-yd. Haiss clamshell handling bucket[4]. This plant unloaded an average of slightly over 100 tons of aggregate, operating less than 5 hr. per 8-hr. day. The average handling capacity was 40 tons per hr. when unloading gondolas, with one or two men trimming. The best day's work observed was 6 cars, or 260 tons, unloaded in one 8-hr. day, as follows:

Unloading (digging)	5.34 hrs.	67%
Yard delays	1.74 hrs.	22%
Other delays	0.92 hrs.	11%

The time per car unloading 100 cars of 45 tons average was:

Unloading (digging)	1.26 hrs.	67%
Yard delays	0.41 hrs.	22%
Repairs and other delays	0.20 hrs.	11%

1.87 hrs. per car or 3.09 Payroll hours (60.5%).

Cement was usually received on the siding, so that it was unloaded direct to the mixer, using board runs on gravity roller conveyors, a maximum of over 1200 sacks being unloaded this way by three laborers in 8 hrs. When cement was not taken direct to the mixer, it was piled alongside the conveyor to be re-handled when required.

The mixer[5] was a Koehring 1-cu. yd. drum type with charging hopper, belt-driven by one 35 h.p. motor, the mixer being set below the charging bins in a pit, with a charging platform at the level of the mixer hopper; the hoist was also electrically driven, with one 50 h.p. motor; the tower bucket was a 36-cu. ft. Insley tower bucket[6]. The charging bins had a maximum storage capacity of about 25 cu. yds. of sand and 50 cu. yds. of gravel when heaped over, but the top surface proved too small for the clamshell bucket used to fill them, resulting in overflowing across the partition. They were on the site when construction commenced—hence the use. Aggregate was weighed separately in balanced steel hoppers, and cement and water were dumped into the mixer from the charging platform. The weigh hoppers were steel plate and angle construction, prism-shaped, carried on one end of 4-in. x 6-in. lever arms with counterweights; they had bottom swing gates with steel spring latches. The usual batch charge was 2200 lb. of gravel and 1200 lb. of sand to 5½ bags of Alpha cement[7]. The mixer plant reached a maximum output of 32 batches per hour over several hours, with full minute period required with all materials in the drum. It was operated over an extended period at the rate of 30 batches per hour, but the actual ratio of mixing hours to concreteing hours was only 80%, limited by the unloading plant at the charging end and by the car operation on the roof.

At the commencement of the contract, it was agreed between the owner and the contractor that all concrete specified as 1:2:4 class and as 1:1.5:3 class should be 2000 lb. and 2500 lb. concrete at 28 days, and the batch charge was designed and the consistency maintained with this in view. Owing to changes in the aggregate and to the different aggregates used, it was necessary to change the mix four times during the progress of concreting, but the strength of the 1:2:4 concrete was maintained slightly above 2000 lb. Test cylinders, 6 in. x 12 in., were made during concreting, in groups of twelve, to be tested at 4 days, 7 days,

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[2] Lidgerwood Mfg. Co., New York, N. Y.

[3] Dake Engine Co., Grand Haven, Mich.

[4] Geo. Haiss Mfg. Co., Inc., New York, N. Y.

[5] Koehring Co., Milwaukee, Wis.

[6] Insley Mfg. Co., Indianapolis, Ind.

[7] Alpha Portland Cement Co., Easton, Pa.

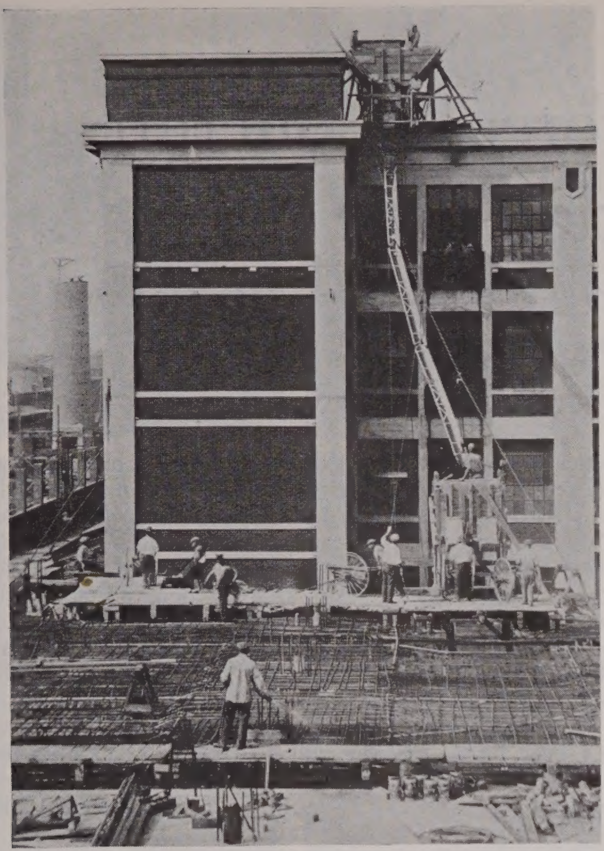


FIG. 6—ROOF HOPPER AND CHUTE TO FLOOR HOPPER ON EAST EXTENSION

and 28 days, in the owner's laboratory at their New Brunswick plant. Cylinders were stored in damp sand outside on the job, calibrated, and packed in damp sand in boxes to go to the laboratory by truck the day before testing. Although, as far as possible, laboratory procedure and control were maintained, one feature of the test work was in the "field" work carried out, to aid in determining what refinements are essential and what field methods will satisfy theoretical (laboratory) requirements. No attempt was made to cap cylinders in the field, but the molds were set up on an oiled steel plate; the slump test was abandoned after it had been found that, owing to the changing and different aggregate used, there was no relation between the slump and "relative consistency"—instead, a limit was set to the amount of water that might be used in the batch, and the consistency was maintained by varying the water added, at the discretion of the inspector in charge. The results were quite satisfactory, and resulted in a more uniform water-cement ratio than had been secured when the amount of water was regulated from the floor. Furthermore, during the operation of the car system, not once was it necessary to retemper a batch too stiff to be handled, nor were there any batches so wet as to result in separation of the aggregate. There was less than 8000 cu. yds. of structural concrete in the structures, and the majority of the test cylinders were made on the east extension, representing some 4000 cu. yds. It will be appreciated that these tests were conducted on an industrial building contract of no great size, by the owner's personnel and laboratory, without previous experience in this work, and it was largely through the interest and at the request of John G. Ahlers, member of the American Concrete Institute, that it was undertaken.

The general contractor for the work was the Barney-Ahlers Construction Corp., of New York, and the work was under the personal direction of L. H. Usilton, general superintendent. The writer was supervising and test engineer for the owners, under George O. Elmendorf.

Simplified Practice in Concrete Building Units

Extensive simplifications of concrete block, concrete building tile, and concrete brick were adopted recently at a conference of manufacturers, distributors, and users of concrete products, held in Chicago under the auspices of the Division of Simplified Practice, Department of Commerce.

Where there were formerly offered concrete block in 30 different lengths, 20 widths, and 26 heights, it was voted to make standard a height of 7¾ in. and a uniform length of 15¾ in., with widths in ranges of 6, 8, 10, and 12 in. It was also voted to make the permissible variation as to height and length ⅛ of an inch under, and the permissible variation as to width ¼ of an inch.

Concrete brick, both face and common, which was formerly made in 6 lengths, 7 widths, and 6 heights, was standardized to a length of 8 in., a height of 2¼ in., and a width of 3¾ in.

In concrete building tile, formerly made in 6 lengths, 7 widths, and 5 heights, it was voted to adopt a standard length of 12 in. For load-bearing tile, a standard height of 5 in. was adopted, and the standard widths adopted were 3¾ in., 8 in., and 12 in. For partition tile, in addition to a standard length of 12 in., it was voted to make the standard of width 12 in.; with the height range in 3, 4, 6, 8, 10, and 12 in. In this class of units, it was voted that the permissible variation, over or under, for dimensions covering height, width, or length should not exceed 3%.

The meeting was presided over by Ray M. Hudson, chief of the Division of Simplified Practice, who was assisted by H. Ross Colwell of the Division.

The attendance included: Leslie H. Allen, general manager, Concrete Tile Machinery Co., Cicero, Ill.; W. D. M. Allan, secretary of the Illinois Concrete Products Association, Chicago; R. H. Barriball, Cleveland Manufacturing Co., Cleveland, O.; C. L. Bourne, Portland Cement Association, Chicago; Harry W. Conway, secretary of the Cleveland Concrete Products Association, Cleveland, O.; A. J. R. Curtis, Portland Cement Association, Chicago; E. W. Dienhart, Acme Concrete Products & Gravel Co., Cement City, Mich.; C. B. Dutton, Besser Sales Co., Chicago; C. H. Goslin, Detroit Concrete Association, Detroit, Mich.; Wallace R. Harris, Concrete Products Association, Chicago; A. E. Lindau, president of the American Concrete Institute, Chicago; J. W. Lowell, Universal Portland Cement Co., Chicago; Eugene Olson, general manager, Anchor Concrete Machinery Co., Columbus, O.; F. A. Owen, Akron Concrete Products Association, Akron, O.; A. G. Swanson, secretary, Omaha Concrete Stone Co., Omaha, Neb.; and S. H. Wightman, of Besser Sales Co., Chicago.

The recommendations for simplification as indorsed are being sent to the entire industry for formal acceptance, as a preliminary to the publication by the Division of Simplified Practice of the standards in its "Elimination of Waste" series.

Wood and Reinforced Concrete Combination Pile

The Handl System—A Solution of the Foundation Problem for Ordinary Houses in Holland

By Henry J. Harms

The all-concrete pile has, especially in America, entirely replaced the wooden pile for certain foundations; but even in America, there are still numerous cases where the use of concrete piles is prohibitive. They are interesting, economically, if the quantity to be driven is large enough, and especially if the value of the superstructure is such that the question of economy of the piling system used is almost of secondary importance, or that the load to be carried is so important that the number of wooden piles required would be too large, as with factories, tall buildings, etc.

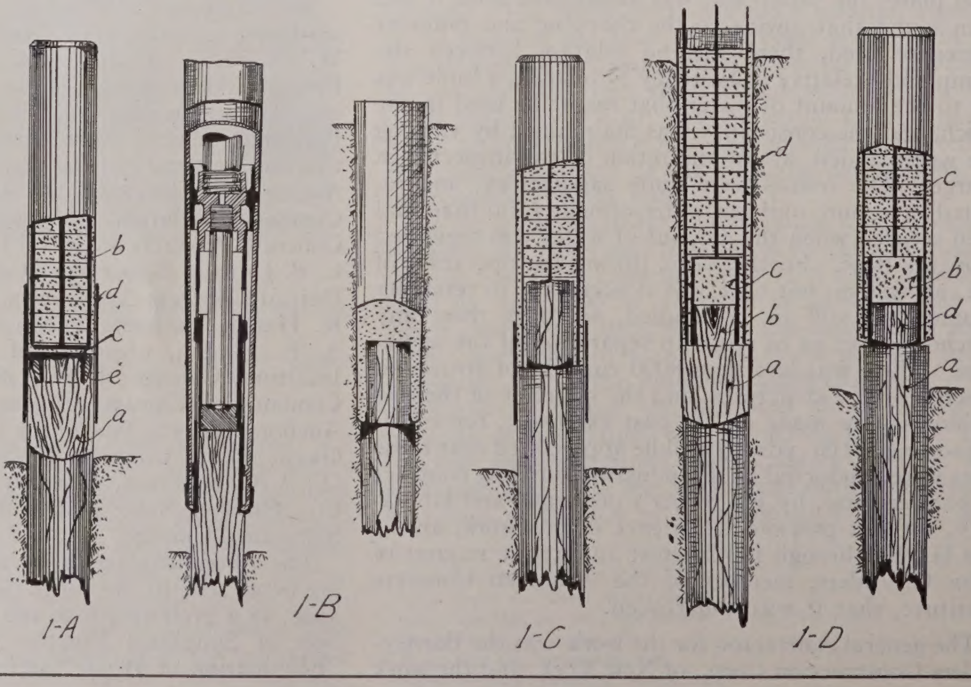
When the superstructure is of little importance, relatively, as with ordinary dwellings, and when the strictest economy is required, especially on those items that do not add to the renting value of the property, to the rentable space, all-concrete piles, although sometimes presenting certain advantages, are too expensive.

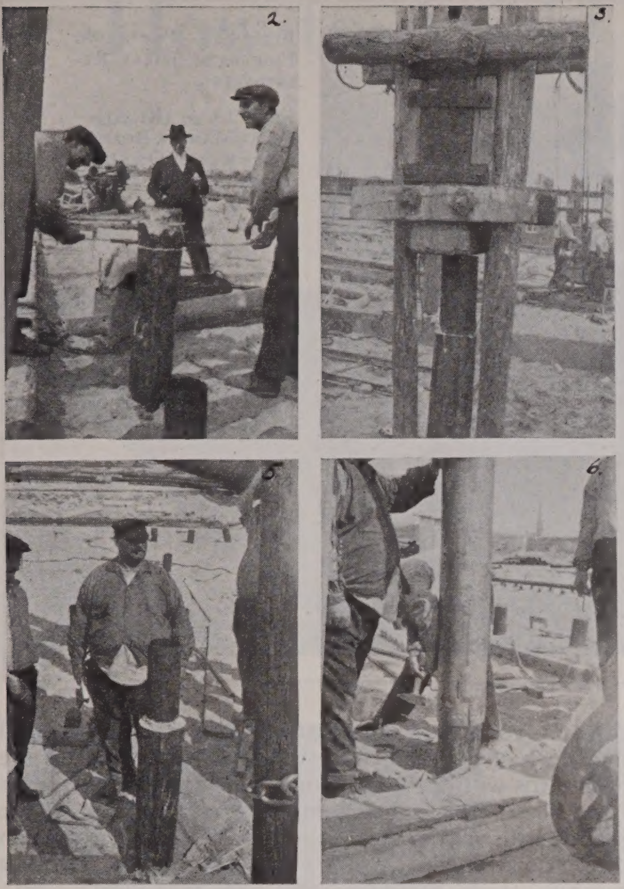
The question of such foundations was, before the War, in Holland, like in most other countries, not considered as any problem at all. Rents were good, and houses were very desirable investments. A few dollars more or less in the cost of a house did not matter so very much—and, therefore, nobody tackled the problem of economizing on the foundations in a serious manner. Certainly, many were the would-be contractors and so-called house-builders who did with the foundations as with the rest of the house—they skinned, and gave as little as possible; their international slogan was, as we all know: "Build no matter how, but as cheaply as possible, and sell as quickly and as dearly as possible." So for the foundations the use of shorter and fewer piles was their way of economizing; would this cause most decidedly serious and dangerous settlements later, cracked walls, etc., demanding costly repairs or wreckage? Who cares? By that time these benefactors of humanity had the houses sold and had themselves disappeared from view and from the building directories.

It is not to such saving we allude, however. Every sea ever had and ever will have it sharks, and the only way to get rid of them is for the serious builders to fight them with clean methods, first-class materials, real economy, good workmanship.

Prices, soaring upward like sky-rockets, caused a general standstill in building operations in Holland, just as everywhere else. And when building started again, under the urge of dire necessity, the strictest economy had to be applied on all points; and it soon appeared that the question of foundations had become a serious problem, especially in a country like Holland, with its poor soil. Thousands of houses were *not* built during those first after-war years, although most urgently needed—simply because they *could not be built* at a price low enough to be rentable. Too much money had to go down in the ground. That some hundred houses were built anyhow was because

Fig. 1-A — Heimbach System of Piling
Fig. 1-B — Maxwell System
Fig. 1-C — Gundersen System
Fig. 1-D—Handl Pile



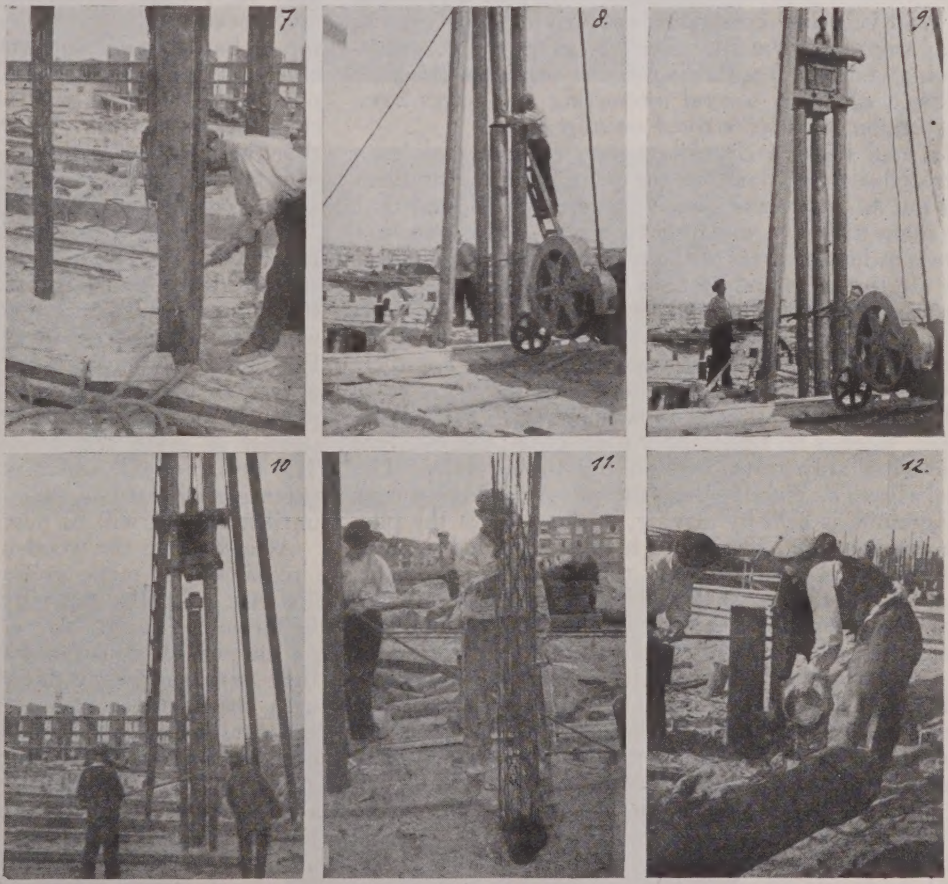


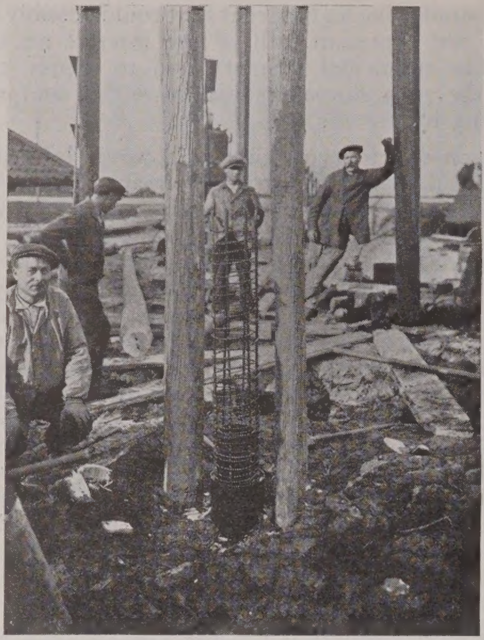
Figs. 2–5—Preparing the Top of the Wood Pile, Handl System

municipalities did it, aided with Government subsidies. Generally, the highest rent that could possibly be asked, did not represent half of the interest on the money. The municipal treasury had to supply the rest, and the poor taxpayers had to suffer, and are still suffering for it.

There is an end to every dream, however beautiful it may be, and so to this altruistic dream. Not even municipalities nor governments can go on forever furnishing houses below cost, and with the return to normal times and sound thinking, came the return to normal building conditions. It is normal that money be invested in tangible things, houses for instance, and it is normal that such investments prove productive. Building had to come back to private enterprise, and it did. And private enterprise forced the focusing of the intellectual minds on points formerly not considered worth while thinking about. And foundations was one of these points which were tackled; everywhere was noticed the search for methods to economize there, first of all. The good old, tried-out system of wooden piling, cut off under water-level, wooden sills built over it whereon the foundation walls were started, was found to be extremely costly, not only on account of the piles, but on account of the important excavations and earth displacements required. In Amsterdam, Rotterdam, and numerous other towns and villages with an extremely low ground-level, it has become a practice to raise this level by spouting-up of the ground with sand. In most places, however, the subsoil is so treacherous, on account of alluvial and dilluvial formations, that even with a deep sand-bedding disposed on the ground, piling is necessary. With the old system, this requires important excavations to water-level, in order to saw the piles off low

Figs. 6–11 — Views Showing How Handl Pile Is Made





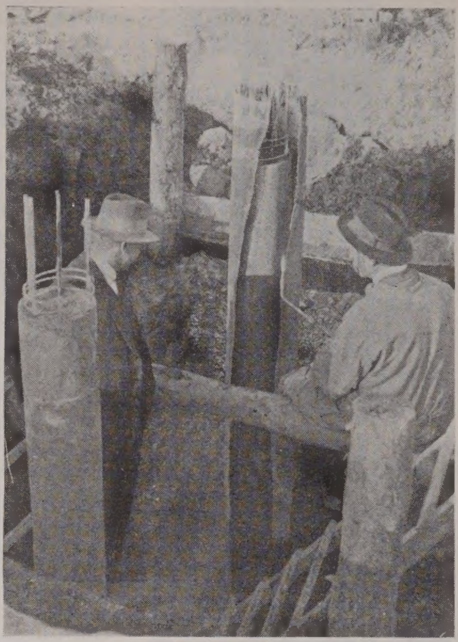


FIG. 12 — PREPARING PILE WITH SPIRAL REINFORCING

FIG. 13 — (RIGHT)— STEEL MANTLE BURNED OFF WITH OXYGEN TORCH

enough, the keeping dry of the pit until the foundation walls are dried out, and then backfilling. With the high price of labor, such foundations very often cost more than the house itself.

All-concrete piles were thought of, but although some money was saved in the excavation, which was, of course, reduced to a minimum, this advantage was largely offset by the very high cost of the piles. Quite naturally, the thoughts turned to a combination of wood and concrete—keeping the wooden pile for that part where it is preserved, under water, on account of its relatively low cost and easy driving, but getting away from the excavation work by using, above water-level, a concrete lengthening piece. And the concrete follower, of which several interesting appliances have been made already, arrived on the scene.

It soon became clear, however, through accidents with followers set cold on the piles, that the problem was not as simple and as easy as anticipated, and that the main difficulty was to get a rigid, solid connection between the two parts of the pile thus formed. Numerous are the ideas and systems proposed and tried, but few are those that survived even the first practical tests.

Of these systems, the following ones may be cited, if not for their practical value, then anyhow for their having shown the way for the solution.

Fig. 1-A shows the Heimbach system. As will be noted, there is no tight, inner connection; the concrete follower simply rests cold on the timber pile. The steel sleeve *d*, placed when the pile is driven to near the ground, is held by driving, in the head of the pile, the wedge-ring *e*. The sleeve is thus depended upon to take up any bending stresses that may occur. If this sleeve is once rusted away, which will surely happen, there only remains a simple butt joint, without any connection whatsoever between the two parts, and no prevention against sliding under side stresses.

Fig. 1-B shows the Maxwell system, where the dowel idea appears. Practically, however, this system is impossible. Not only is the very special hammer awfully complicated, and does not seem to give enough fall for driving in stiff, hard soil, but the blows on the otherwise unprotected head will most decidedly upset this and jam it stiff against the bottom part of the steel guide, placed around it and forming part of the hammer—thus necessitating that the hammer be withdrawn. It would seem that either the pile itself will be drawn out or the pile-driver drawn down before the apparatus will be withdrawn. And, furthermore, there is no possibility to ascertain the correct placing of the mantle afterwards; there is also no effective protection of the dowel against penetration of water. Water once reaching there, the dowel will soon rot.

Fig. 1-C illustrates the Gundersen system, similar to the Maxwell but precast. And here lies also the fault of the system. The connection between the parts is very rigid when made; but after the pile has lain a few weeks in the air, in order to allow the concrete top to harden sufficiently for driving, it is quite probable that the connection is less tight; and the wooden pile itself certainly will not have improved by its exposure to the air. Another serious disadvantage is that the length of both pile and follower must be fixed in advance, and everyone familiar with foundation work knows that this is practically impossible.

For the last two years, the Handl pile, invented by Egi Handl, Dutch engineer, has been used to a great extent in Holland. This system, shown in Fig. 4, shows great improvements on the ones cited above, of which it has not the faults but all the advantages. Further, it is simple, constructively correct, and has proved to be economically and commercially interesting. It is used in two manners, viz. with the top poured in place and as a precast concrete follower. The first method, which is the preferred one for any extensive operations, has been most generally used until now, and will be described first.

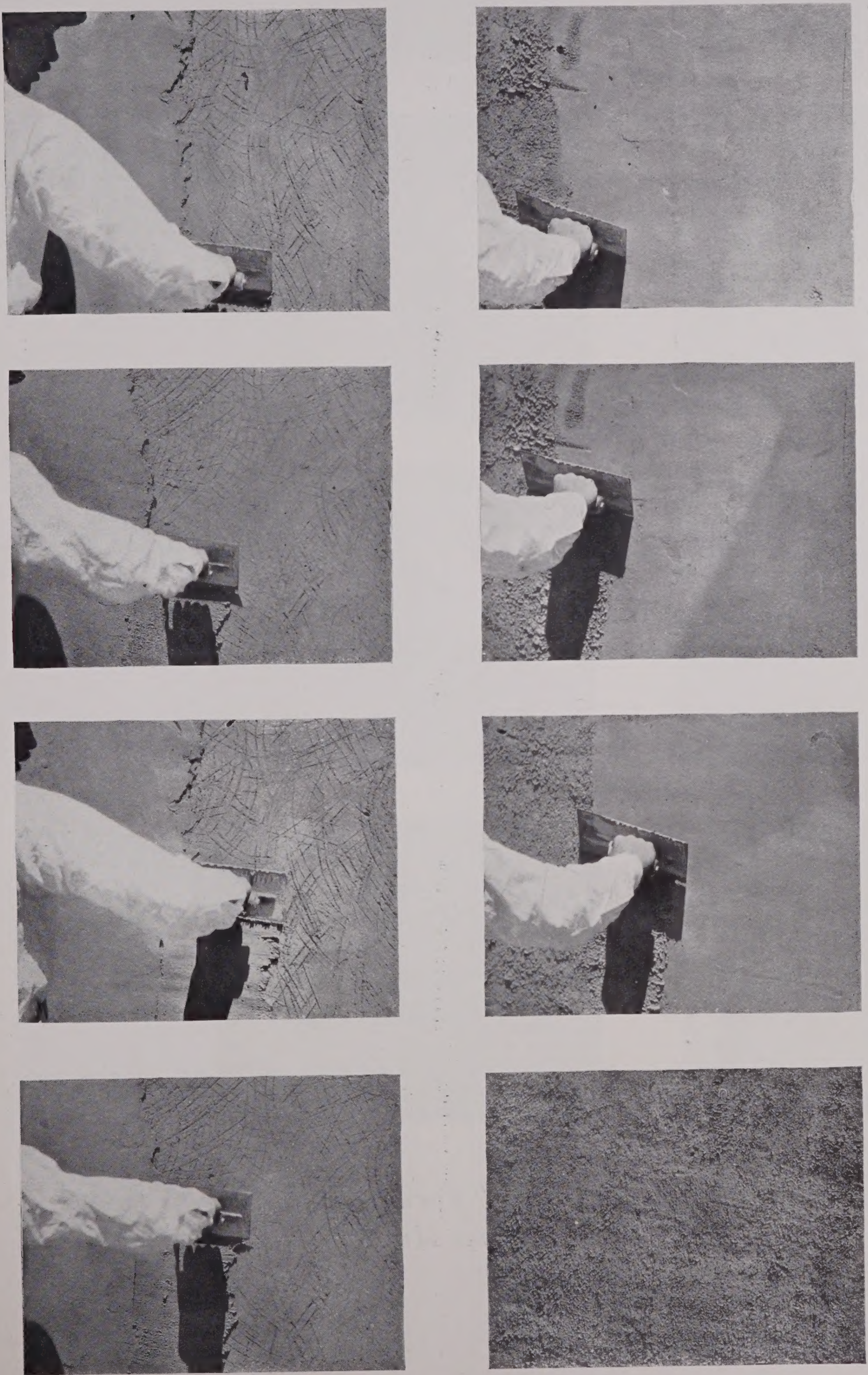
After driving the wooden pile to near the ground, a circular cut is made around the top at the required distance from the top for the length of the dowel to be formed (Fig. 2). Sleeve *c* (Fig. 1-D) is then placed on the pile. It consists of a piece of ordinary seamless tube with somewhat fluted edges (Fig. 7). A blow with the hammer rams it down in the pile to the saw-cut, splitting away the superfluous wood, which is chopped off as in Fig. 4. The thin sheet-iron mantle *d* (Fig. 1-D) is then placed around the top of the pile and fastened to it with some staples, as shown in Figs. 5 and 6. The pile is then driven down further, using a temporary lengthening piece, consisting of a length of strong tubing with appropriate shoe and

(Continued on page 179)

How to Apply Textured Stucco Finishes

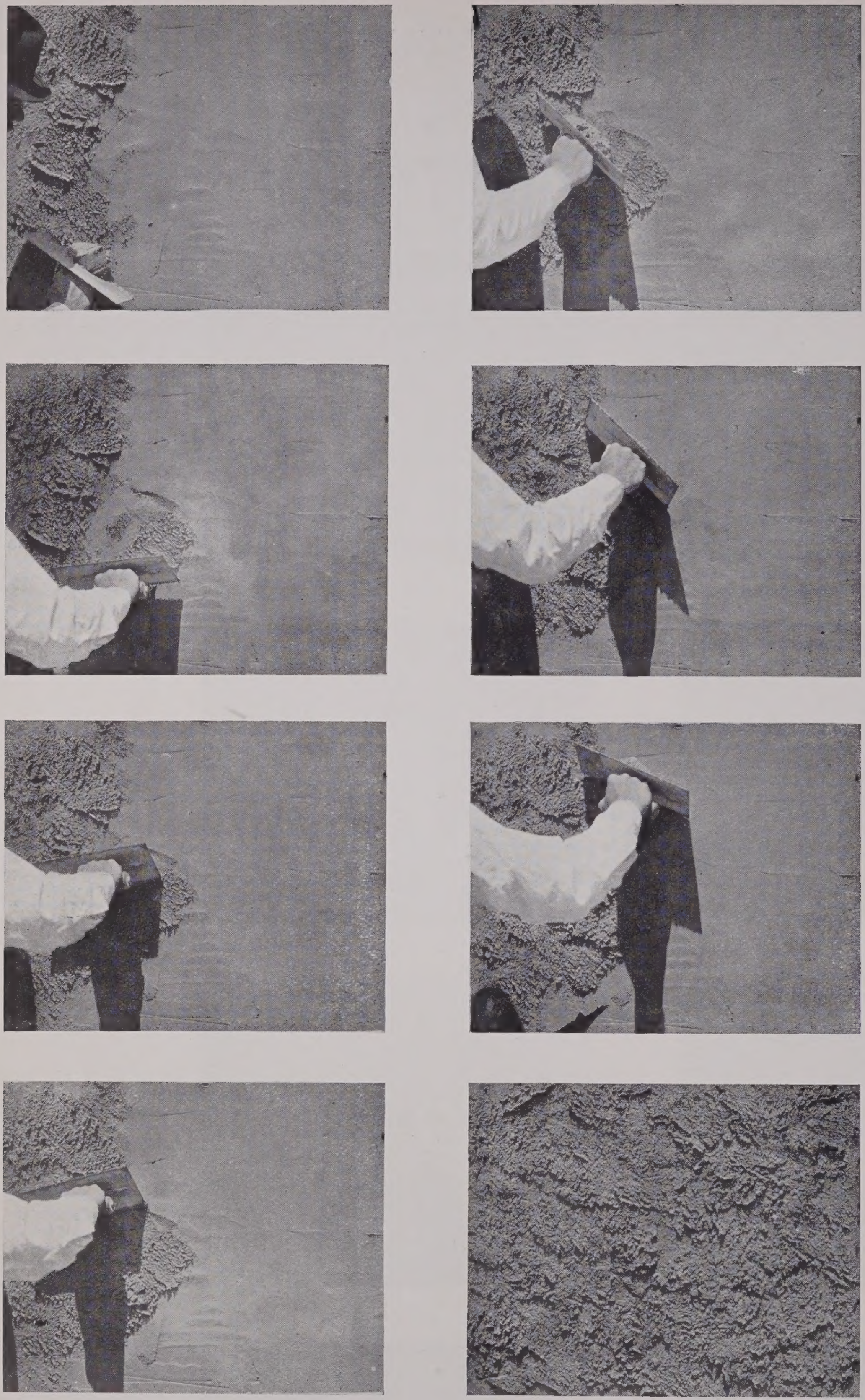
(Continued from October CONCRETE)

BY SAMUEL WARREN
MANAGER, ATLAS-WHITE DEPARTMENT, ATLAS PORTLAND CEMENT CO.



THE EFFECT HERE SHOWN (FINISH NO. 5) IS NOT MUCH ROUGHER THAN A STIPPLE, BUT IS NOT MONOTONOUS

FIRST, APPLY THE FINISH COAT AND TROWEL FAIRLY SMOOTH. THEN WITH THE TROWEL HELD NEARLY AT RIGHT ANGLES TO THE WALL, BRING IT UP WITH A STRONG AND FAIRLY QUICK MOTION

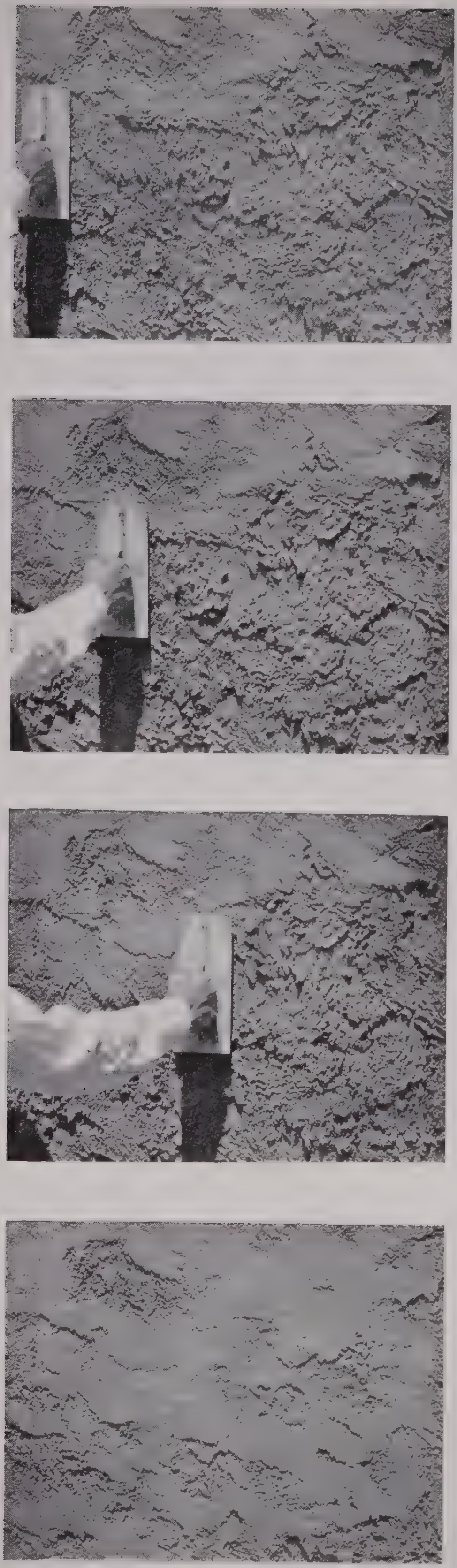


To Produce Finish No. 6 a Fairly Small Amount of Mortar Is Taken onto the Trowel. It Is Applied With the Trowel Held at a Fairly Sharp Angle to the Wall so That the Mortar Is Torn instead of Being Left with a Smooth Surface. The Stroke Is Always Up

The Direction of the Stroke Is Varied, First to the Right and Then to the Left in an Irregular Way. Avoid Giving the Effect of a Pattern

In the First Column of Pictures on the Opposite Page You Will See What May Be Done to Vary the Surface Shown in the Last View on This Page

Finish No. 6 Is the Result of a "Torn" Surface, with the Trowel at a Sharp Angle



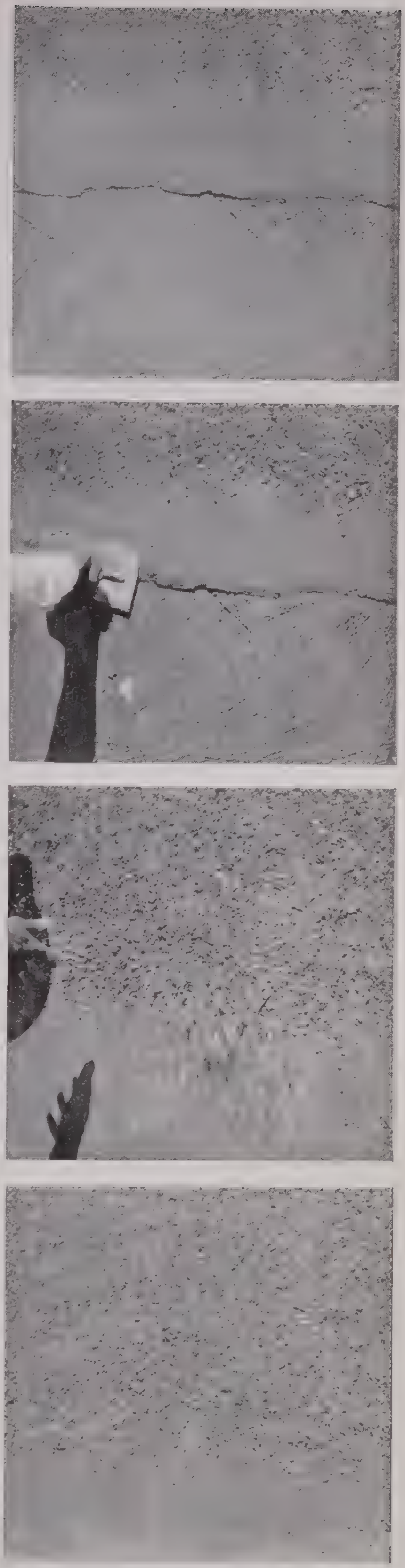
Flattening Out the "Torn" Surface Shown on Previous Page

Finish 6A (in the Column at the Left) is Derived from Finish No. 6 on the Previous Page by Lightly Troweling it While It Is Still Soft with the Trowel Held Almost Flat to the Wall. It Gives Somewhat the Same Effect as Finish No. 4 Shown Last Month, but This (No. 6A) Has, However, More Variation

How to Apply Dash to Stucco (Series No. 7) Is Shown at the Right—In Applying Rock Dash to Portland Cement Stucco, it is Sometimes Found Difficult to Prevent Lines from Showing at Each Drop of the Scaffold. Where Two Portions of the Work Are Joined. When the Scaffold is Dropped, it is Often Found Impossible to Join the New and Old Work Without Leaving a Line, for When the Dash is Thrown on at the Joint it Knocks out Some of the Dash from the Older Portion

To Overcome This Difficulty, the Wall is Thoroughly Wet Down Twice with a Hose the Previous Afternoon and Again Just Before the Application of the Finish Coat. This Wetting is Very Thorough, but it is Still Possible to Make the Finish Coat Hold Without Trouble and Even Though the Thickness is Only One-Quarter Inch, the Finish Stays Plastic and Soft so That at the End of 25 to 35 Minutes the Dash Can Still be Thrown in

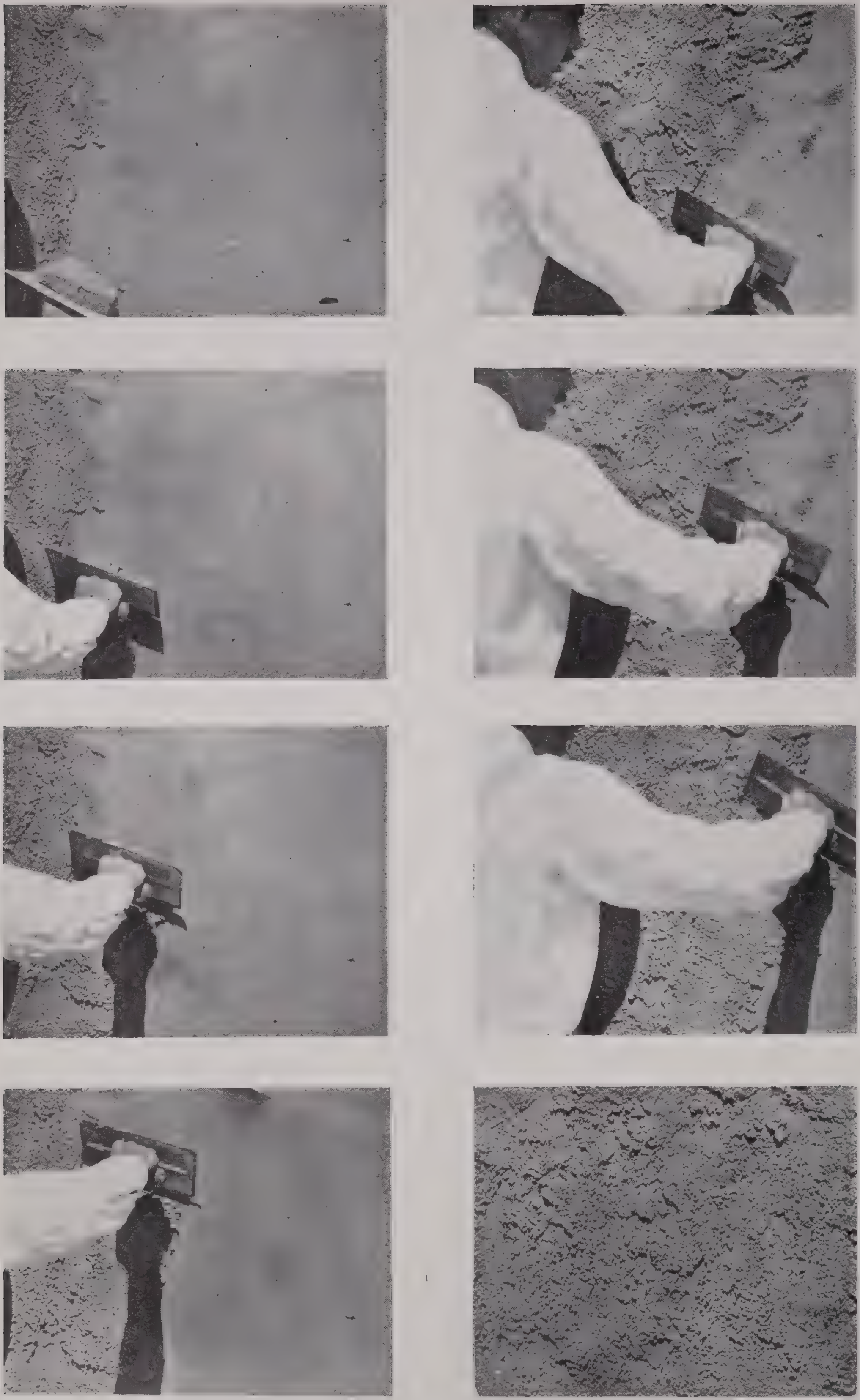
The Dash is Kept Back About a Foot from the Lower Edge of Each Drop of the Work to Further Prevent the Formation of Joint Lines. Then When the Mason Joins on His New Work to the Old, and it is Arranged so That He Can do so in Not More Than 25 Minutes, He Can Trowel the Two Together. The Old Work is Still Soft Enough to Take the Dash. Then the Dash is Applied over the Balance of the Old Section and to Within About a Foot of the Bottom of the New Section



How to Get Good Results with "Dash"

This Finish, No. 8, is But a Variation of No. 6, Reducing No. 6 to a Smaller Scale. The Actual Difference in Application is Comparatively Small, Mainly in Distributing the Mortar More Evenly and with Less Roughness Than Shown in Finish No. 6.

This is Done by Making a Trowel Full of Mortar Cover a Larger Area and Holding the Trowel Closer to the Wall and at Not Quite as Sharp an Angle.



This Is Another Torn Surface, But Not So Rough as No. 6

Combination Pile

(Continued from page 174)

Figs. 14 and 15—Testing Handl Pile

head. The shoe fits in the inner sleeve, which gives it proper guidance. This is shown in Figs. 7, 8, and 9. Furthermore, the sleeve will, by the setting up of the pile top under the blows of the hammer, become so solidly fixed to the pile, that it is impossible to pull it off again, as has been proved by tests. If long concrete followers are needed and a single length of mantle not sufficient, the next ones are added as required, fitting over the lower ones telescopically.

The proper depth reached, the temporary follower is withdrawn and the reinforcing inserted, as in Fig. 9. This reinforcing formerly consisted of verticals and spiral hooping; at present, expanded metal is used, rolled to exact shape on ordinary long bending rolls and stiffened, or not, as the case may be, with verticals. Concrete is then poured as in Fig. 11, and reinforcing left protruding. If the pile is poured to exact height required and the foundation beams and girders built around and over it, one monolithic mass results.

The second method, the precast system, is more used when only a small number of piles are required and where waiting for the hardening of the piles would mean tying up the work. In this case, the pile is driven as before, close to the ground, and then the dowel shaped to fit exactly the inner tube, cast into the follower. A few easy blows with the hammer makes the follower fit the pile snugly, and the whole is then driven further in the ordinary manner, using a cushion head to prevent excessive damage to the head. The pile down, the top is then broken over a certain height to expose the reinforcing, which is woven into the reinforcing of the foundation.

Tests, most of them made under control of the Municipal Building Bureau of Amsterdam, are reported in part as follows:

A test was made in the earlier stages, when spiral hooped reinforcing was used, as in Fig. 12, consisting of six ½-in. verticals with ¼-in. hooping, 2-in. pitch. The pile was dug out and the steel mantle burned off with an oxygen torch, (Fig. 13.) At 1.75 m. above the wooden pile, the load was applied in the manner shown in Fig. 14. At 1500 kilos, there was not any sign of failure, while the pile broke at 1800 kilos (Fig. 15). The break occurred a few inches above the inner sleeve.

With another, straight-load test, the pile was loaded with 30,000 kilos, being ten times the allowable load, which it stood without any sign of failure or deflection.

The last test, made July, 1924, was for eccentric loading; the load applied 50 cm. off center, and pile

Figs. 16 and 17—Handl Piles Tested to Destruction

breaking at 3000 kilos just above the inner sleeve. This is illustrated in Figs. 16 and 17. Expanded metal reinforcement without verticals was used.

PRACTICAL APPLICATIONS

In 1921, the Handl system was chosen, in preference to wooden piles and other systems submitted, for the foundation work of some 1500 houses (6000 apartments) to be built for the City of Amsterdam, and demanding some 40,000 piles to be driven. Inspection was extremely rigid, and in the beginning, every tenth pile had to be dug out for inspection. Specifications were, that if not all the piles inspected were perfect, another 10% would have to be dug out for inspection, and if faults were found, all piles would have to be drawn and driven anew. It was never necessary to test the second lot of 10%, and after some time, it was decided to drop even the 10% clause and inspect only now and then a pile, as would be picked out by the city inspector.

The company exploiting the Handl patent in Holland has at present contracts running for some 20,000 piles, not only for dwellings but also for heavier constructions.

No detail figures as to cost of the piles are available, but on the large work for the city, above cited, that company contracted for the complete foundation work at a figure considerably below the one for wooden piles and foundation walls built over them as of yore. The contractors did well on the price, notwithstanding some unavoidable mishaps in the beginning. Roughly speaking, the net cost price seems to be at least from 25 to 30% below the one of the old system. And this is obvious, as explained in the beginning, by the great saving on the excavation work and foundation walls.

From an examination of the work, the writer concludes, further, that if properly organized and better methods were used, it would be relatively easy to increase the saving and cut at least another 10% off the cost. It is also quite possible that there could be improvements made; the last word is not said, and Mr. Handl himself is the first one to admit this, but even now the results are extremely interesting and permit of great expectations for the future.

The Effect Upon Cost and Size

Using More Cement in Reinforced Concrete Columns

BY J. T. THOMPSON, ASSOC. M. AM. SOC. C. E.
ASSOCIATE PROFESSOR, CIVIL ENGINEERING DEPARTMENT, THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.

The accompanying curves will demonstrate that considerable savings in both money and floor space can be effected by making reinforced concrete columns of a richer concrete than is customarily used in building practice. This thesis is not an entirely new one. The fact that the cheapest way to strengthen a column is to add more cement has been referred to in at least one text-book, and, morover, in 1912, J. Norman Jensen pointed out that cement is the cheapest reinforcement for reinforced concrete columns designed under the Chicago building code of that time.

The writer desires to show that under current specifications and prices, the employment of richer concrete gives rise to cheaper and smaller columns. It is also hoped that the interest of engineers, contractors, and builders may be awakened to the desirability of using richer concrete in columns, a practice which, if more generally adopted, will result in appreciable economy.

The curves are self-explanatory. They result from computing the necessary out to out diameter and total cost of materials per lineal foot of round columns, for both a 1:2:4 and a 1:1:2 concrete for the upper and lower steel percentages allowed by the 1916 recommendations of the Joint Committee. This has been done for both vertical steel combined with ¼-in. lateral ties spaced 1 ft. apart, and for vertical steel combined with 1% of spiral hooping by volume. One and one-half inches of fireproofing was allowed in each case, the concrete strength being figured entirely on the enclosed core. The quantities per cubic yard of concrete and unit prices employed are as follows:

QUANTITIES PER CUBIC YARD OF CONCRETE

Mix	Cement (bbls.)	Sand (cu. yds.)	Gravel (cu. yds.)
1:2:4	1.44	0.43	0.85
1:1:2	2.52	0.37	0.75

UNIT PRICES

Cement, per bbl.	$2.55
Sand, per cu. yd.	1.25
Gravel per cu. yd.	2.00
Main reinforcement, per 100 lb.	3.54
Spiral hooping Lateral ties } per 100 lbs.	5.00

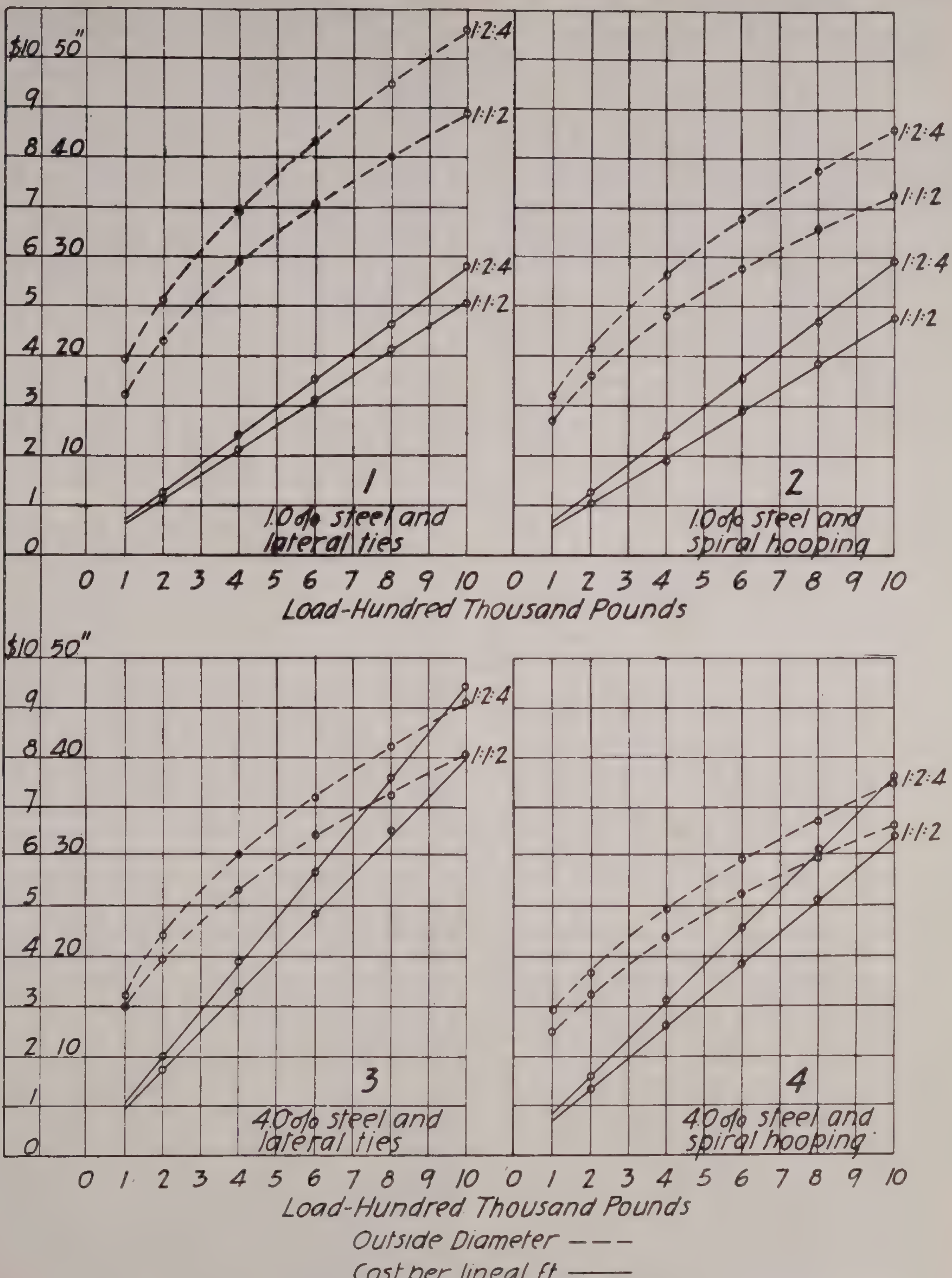
A brief study of the curves will reveal two facts with a direct bearing upon the subject under consideration:

(1) The cost of column per lineal foot is greater for the leaner concrete, everything else, including the workability of the concrete, remaining the same. This increase is relatively greater for the higher column loads, and, taking 500,000 lb. as the average of the load range studied, amounts to from 15% for the most favorable condition (Curve 1), to 24.5% for the most unfavorable condition (Curve 2), an average for the four conditions of 19% on material cost.

(2) The out to out diameter is greater for the leaner concrete, everything else, including the workability of the concrete, remaining the same. The increase in column area at the average load of 500,000 lb. ranges from 26.5% for the most favorable condition (Curve 4), to 41% for the most unfavorable condition (Curve 1), an average for the four conditions of 34%.

Attention is also directed to the following interesting facts which have, however, no direct bearing upon the question under discussion: (a) Cost is directly proportional to load; (b) for the same percentage of vertical steel, columns employing spiral hooping are cheaper than those employing lateral ties; (c) diameters increase much more slowly as loads increase.

The advantages to be derived from using richer concrete in columns are obvious from the foregoing. The monetary saving is appreciable when it is considered that the cost of the materials in the column concrete



CURVES SHOWING EFFECT OF RICHER CONCRETE UPON COST AND SIZE OF ROUND REINFORCED CONCRETE COLUMNS.

is likely to be from 10 to 20% of the concrete material cost of the whole building, exclusive of footings.

The decrease in column area and the consequent increase in available floor space is a factor which will be appreciated by those concerned in designing and erecting concrete buildings on high-priced land.

The Value of Admixtures in Concrete

By G. W. Hutchinson
Celite Products Co.

It is recognized that the "workability" of concrete has an important effect on the ease and uniformity with which it may be placed. Certain concrete mixtures have more plasticity or workability than others, and can be handled with less labor and segregation. The results of research work along this line prove the more workable the mixture, the greater the uniformity of the finished concrete. It is a logical conclusion.

The proper workability has been very difficult to measure. Neither the slump test nor the flow table gives any basis for comparing the workability of various concrete mixes. The importance of workability, however, is being rapidly recognized. This is true to the extent that a specification covering this point will be necessary in the near future if the demand for uniform concrete is to be met.

Considerable interest in this subject was manifested a year ago, when Messrs. Pearson and Hitchcock, of the United States Bureau of Standards, presented a paper at the annual meeting of the American Society for Testing Materials, in which they described a testing method to record the relative workability of different concrete mixes. This method was further described in February, 1924, by the same authors at a meeting of the American Concrete Institute, elaborating on the work done along this line at the Bureau of Standards.[1]

In these investigations, a great number of tests were made which indicate the effect of admixtures on the workability of concrete. The addition of small percentages of admixtures, such as hydrated lime, kaolin, and Celite, was found to increase workability. The addition of Celite was found to be particularly effective. A relative comparison of results secured show that one part of Celite is equally as effective as two parts of kaolin or three parts of hydrated lime in increasing workability.

The work of Pearson and Hitchcock at the Bureau of Standards also included tests on the effect of admixtures on such factors as strength, yield, and density. Their results indicated that the strength of concrete was not appreciably affected by the addition of reasonable quantities of admixtures in concretes of equal consistencies. Inasmuch as workability, rather than consistency, is the factor in field concrete which governs the ease of placement and uniformity, the use of certain admixtures would allow the mass to be placed with a dryer consistency. This would cause an increase in strength to be obtained.

The manipulation necessary to place concrete is the principal cause of segregation and non-uniformity. Manipulation is a factor which is directly related to the workability of the mass.

The investigations of Messrs. Pearson and Hitchcock have recently been supplemented by tests, both in the laboratory and in the field, in actual highway construction, by the State of North Carolina.

The work done in North Carolina to date includes field and laboratory tests of various concrete mixtures with varying percentages of Celite as an admixture. From this work, it is apparent that the economic value of admixtures is more clearly shown by tests on concrete made in the field than by laboratory tests. The true effect of admixtures on the workability, strength, and uniformity cannot be determined in the laboratory when standard methods, especially with reference to consistency, are used. There are many conditions met in the field which are not encountered in laboratory work. Laboratory methods and manipulation will counteract certain adverse conditions the admixture corrects in the field, and thus the value of the admixture is not fully brought out by laboratory tests. The virtue of the admixture lies in its ability to assist in making a more uniform and workable concrete in the field. The uniformity is of decided advantage from a structural viewpoint, and the workability has its value with reference to the economy of placing the concrete at decreased cost, or producing a more uniform, stronger concrete at the same cost. The relative value of different types of admixtures will be dependent upon their ability to accomplish this purpose at the lowest cost.

It must be understood that the use of admixtures of any kind cannot be regarded as a panacea for all causes of variations in field concrete. With such causes divided into two classes—first, the variation encountered in materials; and second, the variation due to manipulation, their ability to correct is only with reference to the latter.

One of the reasons that the importance of workability has not been more generally appreciated is that the great variation encountered in field concrete is realized to but slight extent by the average engineer.

Inasmuch as the use of admixtures is only concerned with the variation due to mixing and manipulation, an attempt is made to analyze the data on this basis. The data plotted in Fig. 1 show the relation between the maximum variation and the number of specimens tested. They represent cores drilled from over 500 miles of concrete road and base work. In this work, the average of all concrete tests of a given age, in months, is taken as a basis for compilation. The variation encountered in the general run of first class laboratory testing is also shown in Fig. 1 for comparison. It will be noted that the variation found in field concrete is greater, as would be expected, when the number of specimens tested is increased. It is also considerably more than that found in laboratory concrete. The points brought out indicate that any means for promoting workability or uniformity in concrete should function much more efficiently in the field than in the laboratory. This is due to the range of variation in the field being so much greater.

The difference in compressive strength between drilled road specimens, corrected for size, and the standard 6-in. x 12-in. cylinder from the same concrete, has been investigated by the North Carolina State Highway Commission on thirty projects. In addition to this, sufficient materials were taken from each of the individual batches of dry materials composing the field concrete to allow specimens to be made and stored under standard laboratory conditions. All molded specimens, both in the field and laboratory, were made by experienced laboratory operators, and the general recommended practice in manipulation was followed. The results given are the average of four specimens of the field concrete and five of the laboratory concrete. Sufficient material was taken after the concrete had been placed to make four of these specimens from different parts of the batch. The location of this batch, with reference to the road, was then marked for the core drill. The field specimens were cured beside the road for 21 days and then packed in damp sand and shipped to the laboratory to test at the end of 28 days.

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[1] "Economic Value of Admixtures," *Proceedings of American Concrete Institute*, Vol. XX, 1924.

TABLE I

SHOWING COMPARISON OF TESTS ON CONCRETE SPECIMENS DRILLED FROM FIELD CONCRETE AND SPECIMENS MOLDED IN THE FIELD AND LABORATORY

	Project	Mix	Field Cast Specimen	Field Drilled Specimen	Laboratory Cast Specimen	Ratio Laboratory Cast Specimen Field Drilled Specimen
1	446	1:2½:5	100	65	116	1.78
2	577	1:2: 4	100	68	62	0.91
3	630-B	1:2½:5	100	79	54	0.68
4	342	1:2½:5	100	86	69	0.80
5	494	1:2½:5	100	94	102	1.09
6	460	1:2½:5	100	96	106	1.10
7	822	1:2½:5	100	100	81	0.81
8	535	1:2: 4	100	101	95	0.94
9	412	1:2: 4	100	107	69	0.65
10	386-7	1:1½:3	100	107	83	0.77
11	643	1:2½:5	100	111	78	0.70
12	671	1:2½:5	100	115	100	0.87
13	428	1:2: 4	100	116	101	0.87
14	741	1:2: 4	100	117	92	0.79
15	632	1:1½:3	100	122	95	0.78
16	588	1:2: 4	100	123	103	0.84
17	473	1:2: 4	100	123	80	0.65
18	743	1:2½:5	100	124	80	0.65
19	614	1:2: 4	100	133	89	0.67
20	429	1:2: 4	100	134	123	0.92
21	484	1:2: 4	100	136	97	0.71
22	463	1:2: 4	100	146	126	0.86
23	528	1:2: 4	100	154	109	0.71
24	765	1:2: 4	100	155	54	0.35
25	679	1: ½:3	100	157	129	0.82
26	742	1:2: 4	100	170	109	0.64
27	670	1:2: 4	100	173	112	0.65
28	790	1:2: 4	100	193		
29	785	1:2: 4	100	198	90	0.45
30	629	1:2: 4	100	204	84	0.41
Maximum			100	204	129	1.78
Average			100	127	93	0.65
Minimum			100	65	54	0.35

NOTE: Field cast specimens tested at age of 28 days and corrected for height. Field drilled specimens corrected for height and age for 28-day results. Laboratory cast specimens tested at 28 days (standard height).

Table I gives the result of this investigation. It should be noted that the relative values are obtained from the result of one correction for size of specimen in the molded field concrete, and this same correction, in addition to one for age, in the case of the field core. The field concrete averaged three and one-half months old when tested. The variables, due to average correction, however, would be relatively small when compared with the variation in the results actually obtained.

It must be realized that the strength of concrete, regarded on the basis of usual laboratory comparison, is the least of the problem to be solved. A few per cent variation from the average strength, whether an increase or decrease, is negligible. The main purpose is to control the uniformity by reducing the variable caused by manipulation. An efficient admixture of any kind which will reduce the amount of labor necessary for manipulation will not only accomplish this result, but will also reduce the cost. There is no economic advantage in design for high average strength if accompanied by great variation throughout the structure, but there is a decided one in concrete of any designed strength possessing uniformity.

Water should never be used to promote workability. Water in excess of a certain amount, approximately at the point of saturation of the mass, induces segregation, non-uniformity, and loss of strength. Any seeming advantage gained by this method is contrary to the fundamentals upon which the design is based.

Workability, in its true sense, must be built into the concrete and not attempted by a washing process, as is the case with excess water. By the use of approved powdered admixtures, the desired workability is built into the mass, it is made uniform and permanent benefits are secured.

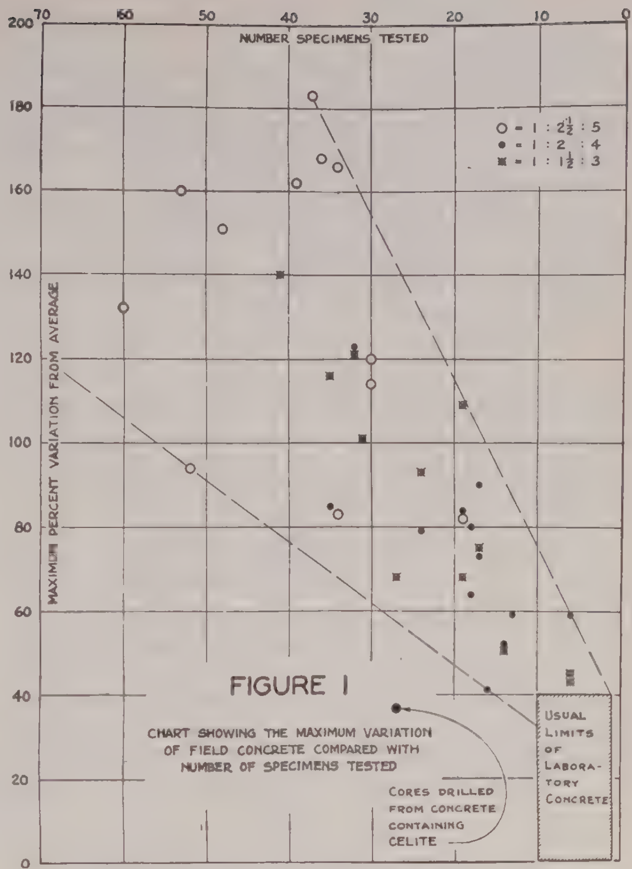

FIGURE I

CHART SHOWING THE MAXIMUM VARIATION OF FIELD CONCRETE COMPARED WITH NUMBER OF SPECIMENS TESTED

Due to the same workability results being secured by Messrs. Pearson and Hitchcock with considerable less Celite than with other admixtures, this material was selected for the work in North Carolina. Yield tests were made to determine the bulking effect of this material. The cost of the material in question is probably as high in North Carolina as in any part of the country, and yet its effect on the yield is such that it can be used at no additional expense whatever in mixtures similar to those used in concrete road work.

The use of admixtures not only eliminates segregation when the mass is being placed, but functions while the materials are in the mixing drum. The usual mixing time is not sufficient to make a uniform concrete, and any process or material used to decrease friction between the particles during this period will allow greater dispersion within the given time.

It has been stated that the effect of approved admixtures on the average strength of laboratory concrete is negligible. This refers to the comparison of strength on the basis of equal consistencies which handicaps the concrete containing the admixtures. Also, such conditions as found in the laboratory will have a tendency to eliminate problems encountered in the field which the powdered admixture is intended to solve. A good example of this might be found in tests of concrete pipe. Tests of laboratory made concrete pipe showed an increase in crushing strength of about 5% when 3% of Celite was added. When the same amount was added in the commercial product, a 10 to 15% increase in strength and greater uniformity was obtained. The same amount of admixture, however, used in the same proportions of concrete (1:1½:3), but placed in the standard 6-in. x 12-in. cylinder, requiring a considerably smaller quantity of concrete, showed no increase. This would indicate that the size of the structure is to be considered. In general, admixtures show no indication of possessing cementing qualities, so that under no circumstances should they be substituted for cement. Their value is in promoting workability and uniformity alone, and their cost should be judged only after the advantage along these lines has been considered. The admixture itself must also be considered, as it does not follow that any material in powdered form will be suitable. In general, the effect of admixtures on workability is in proportion to their fineness.

The admixture referred to as Celite is a mineral product of very high siliceous content produced in California. For use as an admixture in concrete, it is prepared in the form of a very finely divided and light-weight powder.

The relative bulkiness of this mineral per unit of weight, as compared to other products employed as admixtures is quite remarkable.

The relative weights per cubic foot of several such materials are found to be as follows:

Talc Dust	55 lbs.
Hydrated Lime	40 lbs.
Celite	10 lbs.

It should be borne in mind that relatively small percentages of Celite are recommended for use as an admixture. The following percentages may be taken as applying to average work:

Concrete Mix	*Percentage of Celite added*
1:1½:3	1½–3% by weight of cement
1:2:4	2–4% by weight of cement
1:2½:5	4–6% by weight of cement
1:3:6	5–7% by weight of cement

The use of this material has allowed central mixed concrete to be hauled over 5 miles with no evidence of segregation or water appearing on top of the mass. When the concrete was placed, the inherent workability, due to the use of Celite, was demonstrated by the unusual plastic appearance, lack of excess water, and the ease with which it was manipulated.

Financing a High School Stadium

In view of the wide interest in the construction of concrete grand stands and stadia, the story of the financing of a high school stadium, as recently added to the paper by the Portland Cement Association, entitled "Concrete Grandstands and Stadia," is important. This original paper[1] included not only important items for specification for placing concrete in grandstands and stadia, but also cost data and suggestions for design with material quantities and unit costs. The additional information on how such structures can be financed has a direct bearing on the use of concrete in their permanent construction.

Financing the Parkersburg High School Stadium

The highly successful financing of a reinforced concrete high school stadium in Parkersburg, W. Va., forms a story rarely equalled either in the thoroughness of the financing plan or in the civic spirit that made it possible.

This structure is interesting also from a construction standpoint. The stadium is what is known as the deck type, that is, without a roof. In its final form, it will be U-shaped. The work, completed in 1923, forms one of the straight legs of the U, 300 ft. long and 65 ft. wide, or wide enough to provide 23 rows of seats. Aisles 4 ft. wide are placed at intervals of 50 ft. Expansion joints occur at intervals of 150 ft. These expansion joints extend through the entire structure, including the footings, thereby permitting entire freedom of movement to each of the 150-ft. units.

The part now completed is open at the ends and rear, and nothing has as yet been provided in the nature of team rooms or toilet facilities. The main purpose in 1923 was to get well started and to provide sufficient seats for the football season. Final plans, however, call for the closing of the rear and ends through the use of light curtain wall construction of ribbed metal lath and portland cement plaster or cement gunite.

Parkersburg has a population of about 25,000, with perhaps an additional 10,000 in surrounding areas. Consequently, the construction of a stadium to cost ultimately about $90,000 was more than the School Board could undertake. A local organization, called the Parkersburg Stadium Corporation, was accordingly formed under the corporation laws of West Virginia. The management of the corporation is in the hands of a Stadium Commission, composed of eleven members, in which the Chamber of Commerce, the Kiwanis Club, the Rotary Club, and the Lions Club each have two representatives, and the Board of Education has three. This Commission corresponds to the Board of Directors of any business corporation.

The Board of Education granted to the corporation a 99-year lease on the ground to be occupied by the stadium and athletic field. The corporation, on its part, is building the stadium, which will have an ultimate seating capacity of 15,000. The first unit, seating 4800, was completed in time for the 1923 football season, at a cost of $30,900, or $6.50 per seat.

The work thus far completed has been handled through an issue of $35,000 in 7% serial bonds, falling due in 10 years or at any interest period if drawn by lot. All of the bonds were sold locally. Furthermore, as a means of getting sufficient working capital to start with, about 1000 season tickets were sold in advance at a price of $5 per ticket for six games. These tickets were sold through personal solicitation by members of the civic organizations previously named.

One-half of the admission receipts is credited to an athletic fund to cover current expenses of the athletic teams and other running expenses. The other half is credited to the corporation, and is used to pay interest on bonds, to retire the serial bonds as they fall due, and to cover incidental expenses. When the entire stadium is completed, additional bonds must, of course, be sold to raise funds for construction. When all the bonds are retired, either as they fall due or through previous purchase, the lease will be surrendered to the Board of Education and the stadium becomes the property of the city.

The stadium was designed by Folwell, Allen & Merrill, Engineers and Architects, Parkersburg, W. Va. These gentlemen donated their services, and were reimbursed only for actual expenditures. The stadium was built by Plate & Vogel, general contractors, of Parkersburg. Credit for working out the financing plan is due to H. W. Russell, an attorney, who also donated his services. The entire project was handled without a hitch, thanks to the excellent team-work among the various individuals and civic organizations, the enthusiastic support of the newspapers, and the high degree of public spirit prevailing among the people of Parkersburg.

Earnings of the East Orange Stadium

As to probable earnings of a stadium, the following information concerning a concrete stadium at East Orange, N. J., financed under a plan similar to the one at Parkersburg, W. Va., will prove of value. This article is taken from the *Newark Sunday Call* of December 30, 1923.

This year's receipts from football games at the East Orange Stadium shattered all records at the enclosure. A net profit o

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[1] Concrete, April 1924, page 159.

$8,824.44 was made by the organization of suburban men formed to supervise athletic activities at the playfield, it was disclosed at a meeting last night of the Stadium Association.

The receipts from the East Orange-Barringer game on Thanksgiving Day, which attracted the greatest outpouring of gridiron enthusiasts in the history of football in this section, totalled $13,000. When the East Orange men, who projected the stadium in the face of discouragement three years ago, went ahead with the plan to build it, they figured it would be at least five or six years before the total receipts of a season would reach $10,000.

The extraordinary showing in the 1923 season will enable the Stadium Association to pay all bonds expiring this year and to pay off $5,000 on $20,000 that was borrowed from the Savings, Investment and Trust Co., East Orange, when it was found that bonds for $72,000 had been sold and $95,000 was needed to complete the concrete stands.

Constructing a Water Tower of Thin Concrete Sections

By L. J. Pond
Eccleston, England

The accompanying illustrations show the method employed in the construction of a 60,000-gal. water tower which the writer has just erected. Fig. 1 shows the rods for the tank floor. This illustrates the common English practice of thin concrete sections and closely placed steel of small diameter. The floor here shown is 5 in. thick.

From the constructional point of view, the most interesting detail is the supporting of the tank shuttering or forms, by raking struts rising from the string course. These struts are 7 in. x 3 in., running back into the tower. From the outer edges of these are horizontal members, 7 in. x 3 in., passing through the walls through holes left for the purpose. They cantilever by short struts from the tank floor above. Stringers of 7-in. x 3-in. pieces, which support the planks laid around the tower, carry the upper tank side shuttering in a most satisfactory manner.

The circular ribs were 1½ in. thick, with cleats at every joint, and were spaced 3 ft. apart. The 1-in. tongued and grooved upright boards which formed the outside of the tank, will later be used as dwelling house floors. The inner surface was formed by uprights of 3-in. x 2-in. material, with horizontal boards ¾ in. thick. The thickness of the concrete in the wall of the tank is only 5 in.

A central winding iron stairway passes from the ground through the tower to a concrete cover having openings which give access to the tank for cleaning purposes.

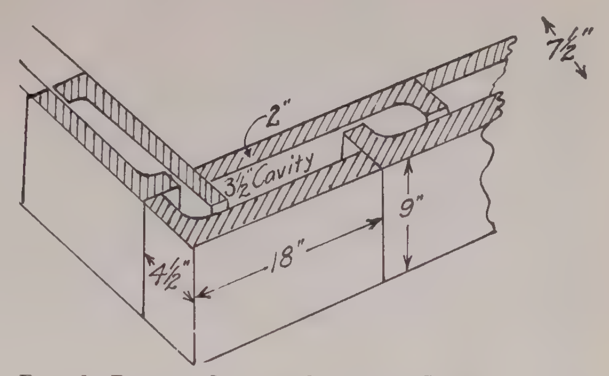


Fig. 3—Diagram Showing System of Concrete Block Used in Building Wall Shown in Foreground of Fig. 2

Steel forms were not used, inasmuch as this size or shape of tower is not likely to be met with again, and there is no such thing as standardization of concrete construction in England at this time. Every designer has his own pet idea as to the correct section of beams and walls. As the designing is invariably in the hands of firms who do not undertake the erection of their structures, but only do the drawings and sometimes supply steel, it will be readily understood why much shuttering or form work of so many different shapes is called for. No doubt in time much of this will be eliminated, but meanwhile competing materials cut concrete out on many projects.

The wall shown in the foreground in Fig. 2 is of precast concrete blocks made in a simple ram pressure machine, and is a two-piece cavity wall. Each block is L-shaped, is 2 in. thick on the long leg and 4½ in. thick on the short leg, set so as to make up a 7½-in. wall. This gives a continuous cavity, the short projections or nibs on each block bearing on the projections or nibs of the block of the opposite face a course below. Set in cement mortar, we figure it more than equal to a 9-in. solid or 11-in. cavity brick wall.

The piers were cast in situ, the one shutter used a dozen times or more, which gave the concrete workers a job when the tower shuttering was in the hands of the carpenters. The caps and copings were cast in our yard and set by the bricklayer who did the walls.

The concrete was all hoisted by a hand winch. The mixer used was not equipped with a hoisting drum, but, within its capacity, it turned out a superior concrete.

No special compounds were used to make the tank watertight, but, just for safety's sake, the mix was strengthened from 1:2:4 up to 1:1½:3. Up to the time of writing, the water has not been turned into the tank, so no information is available as to the success in making a watertight job.

Fig. 1 — Reinforcing Rods in Place for 5-in. Floor of Water Tank

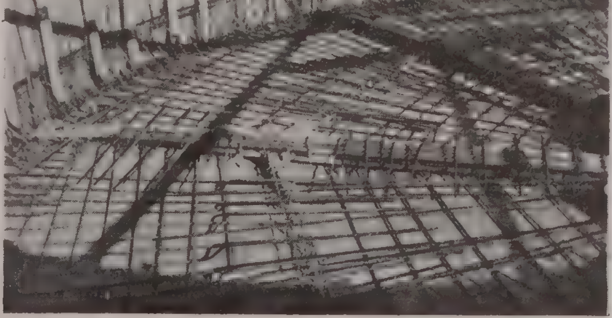
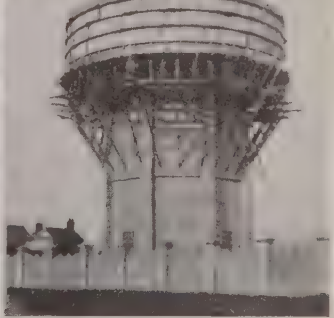


Fig. 2 (Right)—Exterior View Showing Method of Supporting Forms



British Design for 180-Ft. Span Concrete Bridge

By Major Johnstone-Taylor
Lymm, England

The town of Reading, situated some 50 miles up the Thames above London, has recently completed a reinforced concrete bridge, spanning the river with a 180-ft. span. Built on the arch rib principle, the bridge has a rise of 18 ft. only, enabling the approaches to be laid at even grades of 1 to 30. The half longitudinal section in Fig. 1 will serve to make clear the general form of the ribs and the subsidiary members, while Figs. 2 and 3 give two half cross sections showing both internal and external ribs. These, while of different depths, are all at the same level at the soffit. The abutments are of mass concrete, that portion of the roadway over the abutments being carried on arches, two of which are false arches while the center one is open. The approach on one side is carried upon a series of arches and piers, the other being in the form of a short earth bank leading up to the splayed wing walls at the end of the abutment section. The arched approach, being of more or less orthodox construction, calls for little or no comment.

Referring to Fig. 1, the mass concrete abutments, already mentioned and seen on the left, are 50 ft. long x 45 ft. wide, and are constructed of concrete, reinforced by 1-in. bars on 12-in. centers near the lower end. The portion marked *a* in Fig. 1, which extends the width of the bridge, is designed to take the direct thrust of the arch, and for that purpose is strongly reinforced. From this spring, the main arches, four in number, supporting longitudinals *b* which, in turn, carry secondary beams *c* and the decking *d*, while between the main arch ribs are four sets of horizontal braces, two of which are seen at *e* and *e*^{1}.

The Ribs

The outside ribs, as will be seen from Fig. 2, are 48 in. wide by 31 in. deep, the depth increasing to 56 in. at the spring line, while the inner ribs are somewhat larger, that is, 54 in. wide by 42 in. deep at the crown, the depth at the springing being 56 in., the same as the external rib. The spandrel columns *f*, Fig. 1, have a section of 10 in. x 24 in., except for those at the end marked *f*^{1} which are 10 in. x 16 in. They are located, as shown, at 10-ft. centers. The main reinforcing bars of the ribs are 1¾ in. round. The inside ribs have 14 bars top and bottom at the springing, increased to 18 bars at the center. The outer ribs have 7 bars top and bottom at the springing, also increased to 18 at the center. These bars all run out into and are anchored in section *a*. The links are mainly ¼ in. rounds on 18-in. centers, except around the outer bars where 5/16 in. rounds on 6-in. centers are used.

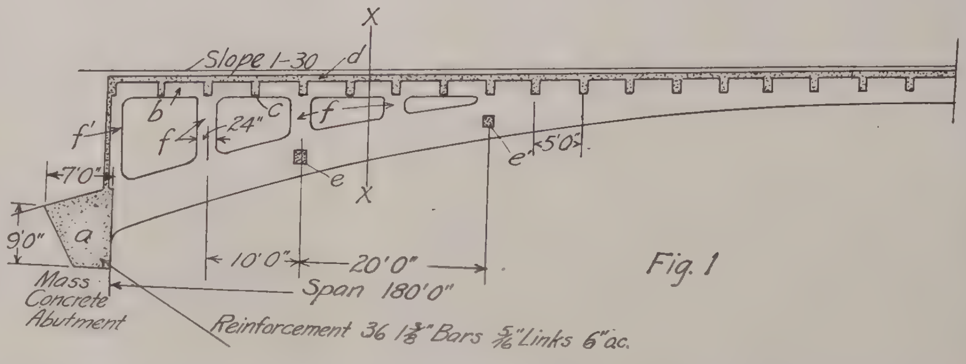
Beams and Decking

The main longitudinals (*b*, Fig. 1) are supported as shown on the spandrel columns and are 10 in. wide x 20 in. deep, reinforced with two 1-in. bars at the top and two 1½-in. bars at the bottom, with 5/16 in. stirrups on 6-in. centers. The depth of 20 in. is exclusive of the deck slab, which is 7½ in. thick. The secondary beams (*c*, Fig. 1) are spaced as shown at 5-ft. centers, the normal depth, as shown in Fig. 2, being 14 in., while the width is 7 in. These secondary beams between the internal arches are reinforced with four straight and curved bars 1 in. diameter, and between the external arches and the internal ones with four straight and curved bars 1⅛ in. diameter, in addition to which are 5/16-in. stirrups on 6-in. centers, reduced to 3-in. centers at the beam ends. The upturned longitudinals are taken across the main beams. In the center part of the arch, it will be noted that the secondary beams extend from the arches on account of the longitudinals running into the ribs. This construction serves obviously to stiffen the ribs, but as this is lacking in the approach ends of the ribs, the cross braces *e*, *e*^{1} are introduced, these having a section

Fig. 1—Section Showing Mass Concrete Abutments and General Outline of Bridge

Fig. 2—Half Cross Section at Center

Fig. 3—Half Section at X-X, Fig. 1



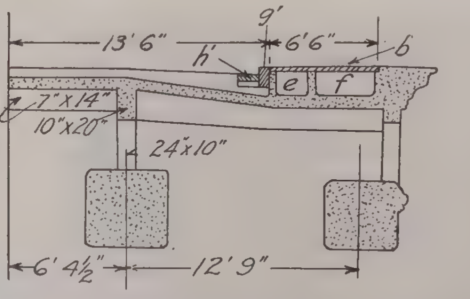


Fig. 3
Section X–X

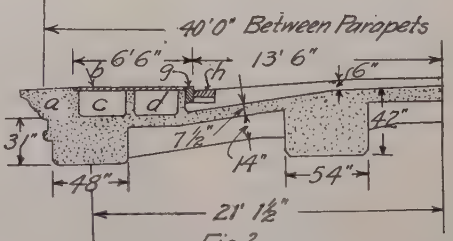


Fig. 2
Cross Section at Center

of 14 in. x 14 in. reinforced with four 1¾-in. corner bars with ¼-in. links on 6-in. centers, while the spandrel columns are similarly reinforced with 1-in. corner bars and ¼-in. links.

From Figs. 2 and 3, the arrangement of cornice *a*, footway slabs *b* and b^1, and troughs *c*, *d*, *e*, and *f* will be clear, these being in the order stated for two 9-in. water mains, two 4-way cable ducts, sundry telephone cables, etc., and two 12-in. gas mains. *g*, g^1 are granite curbs, and *h*, h^1 channel stones. The bridge, which, it will be noted, is constructed mainly on the Hennebique system, is a good example of a soundly constructed utility structure which, while having a pleasing appearance, is devoid of unnecessary embellishment. The heavy cornices enhance the appearance, which is added to by the parapets of Portland stone. Otherwise, the work follows the lines of well-tried practice, the somewhat heavy scantlings being called for by reason of the flatness of the arch and the conditions of load—293 tons rolling on the road, plus 112 lb. per super foot on the footways.

Poor Concrete Fails

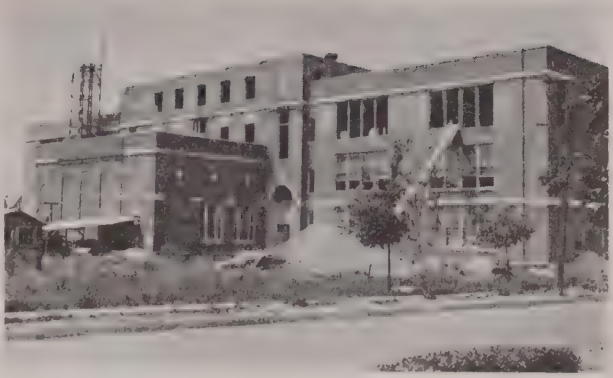


Fig. 1—School Building No. 68, Buffalo, N. Y. with a Pile of Concrete in the Foreground Which Has Been Found Defective and Has Been Replaced by New Concrete

The discovery of faulty concrete work in School 68, at Westminster and Berea Streets, Buffalo, N. Y., before the building was completed probably averted serious accident. Investigations to place the responsibility for the faulty construction work proved that the specifications which called for a heavily reinforced concrete of 1:2:4 proportions, the aggregate to consist of the best Niagara River gravel, were by no means met. Floors, stairways, supporting columns, and the balcony of the auditorium were all to be of this type of construction. Examination of the scrap concrete since torn out of the building, reveals that the proportions can hardly have been better than 1:2:6.

According to the chairman of the school board, it is obvious that defective material was used. There were stones as large as one's two fists in the aggregate and consequently in the concrete.

The work of placing concrete was done in zero weather at the start, and was carried on while the weather was still extremely cold. Evidently the concrete froze to a certain extent before it had an opportunity to harden. As the weather continued cold, the defects in the concrete were not revealed until the work was practically completed. When the discovery was made, all the concrete work but the roof and upper stairways was completed. This was in April, the date of the first genuine thaw.

The concrete in the building began to go to pieces, as shown in the accompanying illustrations. Large blocks fell out of the columns, the floors cracked, and the stairs chipped off to a depth of several inches in places. In some of the columns, nothing was left but the core of concrete around the steel center, with the reinforcing rods left practically free on all sides.

The concrete members had to be torn out and the concrete repoured. This work is practically complete, the repairing and rebuilding of the structure having been assigned to the Turner Construction Co.

Arthur H. Blanchard, M. Am. Soc. C. E., Professor of Highway Engineering and Highway Transport, University of Michigan, has been appointed by Governor A. J. Groesbeck and Commissioner Frank F. Rogers, Consulting Engineer to the Michigan State Highway Department.

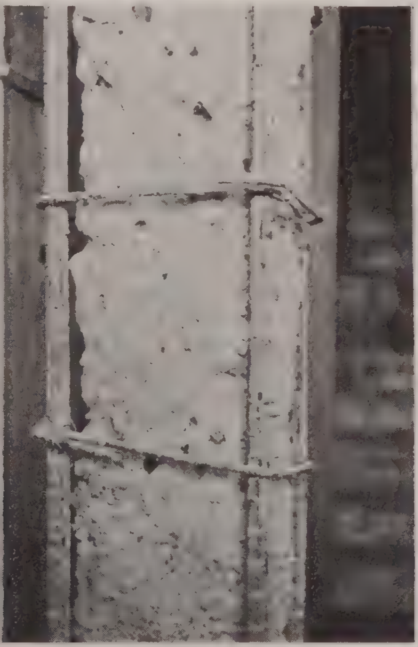
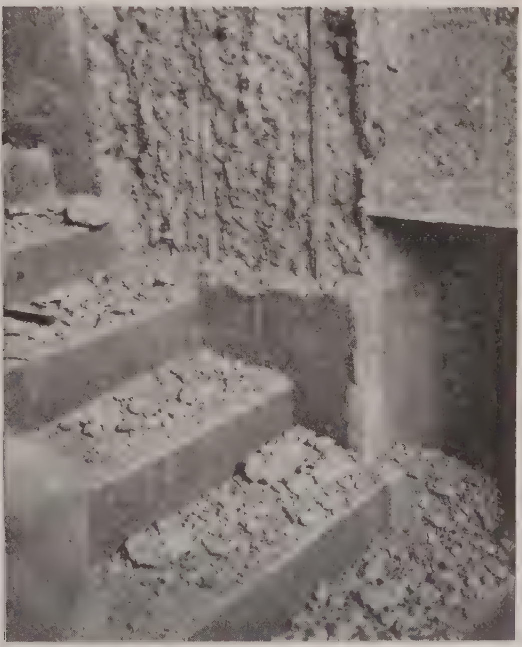



Fig. 2 (Left) — A Close-up View of a Vertical Column Showing the Reinforcing Rods Exposed After the Concrete Was Removed from the Surface

Fig. 3 (Right) — Condition of Staircase Between First and Second Floors

Storing and Handling of Materials for Concrete Products

By William F. Lockhardt

(Continued from October issue)

Reclaiming from Storage

The problem of reclaiming from storage is akin to the problem of excavating in a bank, and as the storage pile is usually being worked at a time when it is not practicable to operate the bank, the same methods and equipment can often be used.

The locomotive crane or crawler with clamshell bucket will naturally be used where it is available. Where the storage pile has been built up with slips or scrapers, or automobile trucks, the portable digger or wagon loader may be called into play. It is well suited for this work, because it can be readily shifted from place to place, it digs and elevates at the same time, and being operated by gas or electric power, does not require a licensed engineer to run it, nor is a fireman necessary to get up or maintain steam. Where the yardage involved does not justify the investment required for a wagon loader, one of the many types of portable belt conveyors available can be employed by using a man to pull down material from the storage pile onto the belt. These conveyors built for handling bulk materials are fitted with a small charging hopper at their lower end to facilitate loading. Either of these pieces of equipment will fill a truck, side-tip or skip car, or feed onto a regular conveyor belt. Where it is necessary to operate the portable belt conveyor at an angle too steep to carry sand with a plain belt, various types of cleats or "flights" can be attached to the belt to keep the sand from slipping down.

Where the plant operation over the winter is on a scale to justify the expense of the installation, one of the simplest means of reclaiming material from storage is by means of a belt conveyor operating in a tunnel under the storage pile. The storage pile should then be long and narrow, in order that the material which does not flow through the sand gates in the roof of the tunnel by gravity may be shoveled through with the minimum labor. The belt conveyor may slope upward at the discharge (plant) end, unloading into the mixer bin or silo, or the tunnel may be extended horizontally in order that the belt conveyor may discharge into the boot of a bucket elevator which will elevate the aggregate and fill the mixer bin.

A modification of this system, which can be employed where the quantities to be handled do not warrant the cost of a belt conveyor, is the use of a skip car operated by cable from a power hoist. This method of operation, however, requires the continual presence of a man in the tunnel to load the car each time. The car, however, can be made to serve as a gauge to measure the batch, so that the man at the mixer, no longer having to perform this job, can be used to operate the simple hoist by which the skip car is hauled to the plant.

Receiving Materials at the Plant

The layout of the plant and the set-up of the plant equipment depend to a large extent on the method by which the aggregates will be received. Many methods and combinations of methods are in operation at different plants to meet peculiar local conditions. The principal means by which aggregates are usually received have been set down below, with notes on items of equipment commonly used, with particular reference to their adaptability in building up storage piles.

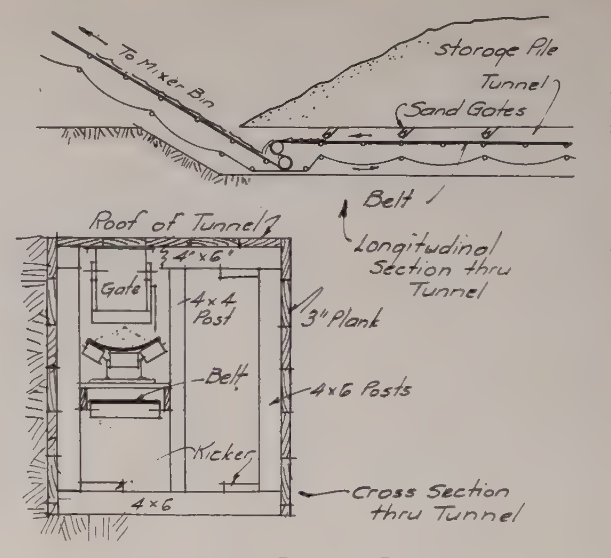


Fig. 3—Tunnel and Belt Conveyor Details

1. Receiving by Water Barge or Scow—*(a) Stiffleg or guy derrick.* Usually unloads into a mixer bin or hopper of 100 to 150 cu. yds. capacity, piling the remainder of the barge or scow load in storage at some convenient point from which it can be reclaimed in the interval between barges. Such storage pile will usually be conical in shape, thought in some cases it may follow the swing of the boom. In either case, the cross-section of the storage pile will be roughly triangular, and the ground area required for a given storage capacity surprisingly large. For example, sand is usually delivered in the East in barge loads of 400 to 500 cu. yds. Assuming that the storage bin will hold 100 cu. yds., 300 to 400 yds. must go into the storage pile. If the sand will stand on a slope of 1½ to 1, a pile 15 ft. high and 45 ft. in diameter at the base will be required to store 300 cu. yds.

(*b*) *Locomotive Crane, Crawler, etc., equipped with Clamshell Bucket.* Because of its mobile character, this equipment has decided advantages over the derrick. It can unload in emergencies at places up and down a wharf that would be out of reach of a derrick. It can build up one or two long stock piles working from one track, or by spacing two tracks a distance apart about equal to the reach of the boom, a wide storage pile can be built up with some hand labor to trim the center solid full. In congested areas, working in and around buildings, etc., the locomotive crane or crawler can build up a number of smaller piles wherever sufficient ground area can be found to make the effort worth while.

2. Receiving by Rail (material being shipped in standard or hopper-bottom gondolas).—*(a) Overside by shovel into cars, trucks, or ground storage.* Where cars or trucks are being loaded direct from the railroad cars, it is usual to employ a small portable steel hopper which can be hung from the side of the cars to keep the gang working steadily in the interval between trucks and to speed up truck loading by having the major portion of a load in the hopper by the time the truck arrives at the car each time.

(*b*) *Portable digging-type bucket elevator* which travels on an overhead rail alongside track, so designed that the bucket elevator can be lowered into the car, where it will dig and elevate until the car is empty. One man is usually required in the car at the same time to shift the bucket elevator from place to place, and to trim up the corners and other places that the bucket elevator may not or cannot reach. Such an arrangement may be employed to build up a continuous high storage pile alongside the tracks, to be reclaimed later by other methods, to fill a series of bins or hoppers, or to load cars, trucks, or belt conveyors, or bucket elevators.

(*c*) *Car Unloader, for use with hopper bottom cars.* This is essentially a form of wagon loader, with a horizontal extension at the lower end to reach in under the hoppers of a car and receive the material as fast as it flows through the hopper gates. Can, of course, be used to some extent to build up storage piles, but its chief field lies in the unloading of cars mechanically without the expense of installing a track-pit and bucket elevator, etc. With a hopper on the upper end, can be used to load trucks and cars quickly and economically.

(*c*) *Track pit and bucket elevator or belt conveyor.* Hopper bottom cars are discharged into a track pit or hopper under the rails, the hopper being so shaped that the aggregate is discharged through a gate or feeding device onto either a bucket elevator or belt conveyor, by which the aggregate is handled to the mixer bins or the storage pile. A horizontal extension of the belt conveyor past the top of the bins will make it possible to build up a conical storage pile almost the height of the bins and immediately adjacent thereto. A swinging chute at the discharge end of the bucket elevator or the belt conveyor will serve the same purpose, and will distribute the storage over a wider area.

(*e*) *Trestle,* by which the railroad cars are brought into the plant at a sufficient elevation to dump directly into the bins under the track between the trestle bents. A row of these bins can back right up against the rear wall of the plant building, and the aggregate withdrawn through gates opening directly into the mixer room. These gates will necessarily have to be close to the floor, and a skip loader on the mixer will be desirable, if the products machine is not equipped with some form of elevator for raising the concrete. A small skip or tip car will be needed to convey the aggregates from the various bins to the mixer. The ordinary 6-ft. concrete cart can be used, a hopper slung from an overhead track, or a car running on rails.

(*f*) *Embankment,* where the railroad runs past the plant at a higher elevation than the ground on which the plant is built. This is practically a modification of (*e*) except that a track pit may be installed with a short length of belt conveyor to bridge the gap between railroad and bins.

(3) *Receiving from Pit or Bank*—(*a*) *Slips or wheeled scrapers* are usually dumped as close as possible to the boot of a bucket elevator, the aggregate being shoveled into the boot by one or two men.

(*b*) *Side tip or mine-skip types of cars* usually enter the plant at considerable elevation, and where they are used to measure the batch as well as convey it, they may be dumped directly into the mixer. For filling bins, the mine-skip car is better than the other, as it is self-dumping. The type generally employed is open in front and on top, and the front wheels run on a track whose gauge is several inches less than for the rear wheels. At the dumping point, the inner rails for the front wheels are continued straight ahead, while the outer rails, for the rear wheels, are run upward at a sharp angle. As the car reaches the end of its travel, the rear end is thus automatically elevated sufficiently to discharge the load through the open front part of the skip.

(*c*) *Belt conveyors and bucket elevators* naturally can be placed to deliver material to top of bins, care being taken to see that the point of discharge is so located that the bin is uniformly filled.

(*d*) *Trucks* may deliver to the boot of a bucket elevator, or by means of a short ramp and trestle dump into top of low bins. A good type of construction for this purpose is a solid runway for the truck wheels with a grid between made by using floor beams 3 in. or 4 in. thick and 3 in. or 4 in. apart. The spacers are short pieces of the same beams, and are placed so that they will form the solid runway for the truck wheels, while the space in the center between the wheel-treads is sufficiently open to enable the truck to dump through at any point, yet not so open that a man can fall through.

(*e*) *A dragline scraper* may deliver to the boot of a bucket elevator or a belt conveyor, or it may be rigged to deliver to an overhead bin.

Cement. So far as possible, the cement storage should be close enough to the mixer to enable the mixer man to handle cement. In some plants, the cement storage is carried on the mixer floor level, piled between the mixers and the wall, so that the mixer man merely has to turn around each time to get his sack of cement. Where the mixer floor is on a mezzanine, the cement can be elevated to the mixer floor level by a portable belt conveyor as needed, but as this ties up the time of one man moving cement from storage all day, it seems better practice to make the mixer floor a little heavier and elevate the cement to the mixer floor for storage at the time it is received.

Gravity roller conveyors have been used with considerable success in many products plants for handling cement. The bags are piled on small platforms or pallets made of 1-in. boards with the battens on top (to present a smooth surface to the rollers), and anywhere from four to a dozen bags can be handled this way at a time. If the roller conveyor is properly set up, so that the grade is even and the construction solid so that there will be no deflection under load, satisfactory operation can be had with grades as flat as ⅛ in. per ft., although ¼ in. per ft. is preferable. Curved sections are provided, and the pallets loaded with cement bags will ride the curves without hitch as long as the cement is not piled high enough to be overthrown by centrifugal force.

Bulk cement is very little used in eastern concrete products plants, according to a survey recently made of the mechanical equipment being used. Various devices for handling cement by compressed air have been developed, and some are in use in cement mills, but most of the installations are too elaborate for use with the relatively small amount of cement handled by the average products plant.

Provision for Winter Construction

Provisions designed to insure the carrying on of winter building are included in the agreement of Baltimore Local 155 of the Operative Plasterers and Cement Finishers International Association. Under the terms of the agreement, all buildings on and after November 1 to April 15 must be inclosed in a suitable manner to exclude weather conditions. From November 15 to March 15, all buildings must be heated to 40° before the worker will be allowed to go on the job. The agreement is effective until May 1, 1925.

Advertising Suggestions to Products Manufacturers

By R. Marshall
President Concrete-Cement Age Pub. Co.

One of the greatest sins of business is *complacency*.

Complacency is for the sloth. Complacency saps energy, dulls the wit, kills initiative, and is an opiate for enterprise.

The man who has built up what he fondly believes to be the world's best mousetrap and sits in his hut in the wood waiting for the world to make a beaten path up to his door, is living in an ancient age.

He is a sit-stiller, and a go-getter with perhaps an inferior mousetrap will shout his wares from the house tops and get the business.

If you have a commodity that will serve humanity, don't keep it a secret.

Advertising is a form of salesmanship. Advertising must not be depended upon to sell goods for you. It simply lubricates the machinery of selling. It lessens resistance. It makes selling easier.

If I go to your plant to sell you a motor, I can more easily sell you a General Electric than I can a Hassenpfeffer motor. You never heard of a Hassenpfeffer motor—don't know anything about it. I have to explain it to you, show you a lot of tests and testimonials, and even then you have to take my word for it that it's a good motor. But you *do* know a General Electric motor. You probably don't remember where you saw it advertised, nor when, but somehow you have a feeling that if the General Electric people make it, it must be good—it must be worth the money.

That's an example of one of the chief results of advertising rightly conducted—the creation of *good will*.

And perhaps the most important factor in advertising is *continuity*. There is no substitute for continuity in advertising. Referring again to General Electric, they advertise *all the time*. They observe the seasonal requirements of seasonable goods, but all the time they advertise the name and policies of General Electric. They recognize no "dull times" when advertising effort may safely be abandoned, simply because people are not buying. The greatest result they get for their millions of advertising dollars is *prestige*. Prestige can be built in dull times just as easily as in active times, sometimes more easily.

How many of you remember the small advertisements carried in newspapers—just an inch or two—advertising Royal Baking Powder? Those advertisements sent millions of women to the grocery stores asking for Royal. Those were direct results. But what was the greatest result? The creation of good will—*prestige*. How tangible was that result? So tangible that ten years ago a syndicate offered two million dollars a letter for the name Royal as applied to baking powder—ten million dollars for the good will created by advertising. No factories, no stocks of materials nor finished goods nor office equipment—all they wanted was that five-letter name and the goodwill attached to it.

These things are retailed here because perhaps there is some danger of you manufacturers becoming too complacent—too well satisfied with your product and the present demand for it. Maybe it's difficult for you to see why you should advertise when you are behind on orders.

Do you believe in fire insurance? Do you wait until you see your factory in flames before you take out an insurance policy?

Advertising is business insurance.

No matter how good your product is, you cannot expect a fierce demand for it to keep up indefinitely.

The better your product is and the more active the demand for it, the more certain you are of stirring up competition. Even though you may have perhaps the monopoly of a very special article, you have no guarantee that some smart fellow isn't going to bob up tomorrow with another totaly different article to serve the same purpose.

Of one thing you *are* certain—if you are the only man in town who can supply a certain article, every ounce of demand that you create for it will bring business to your plant and to none other.

Now the greatest curse of advertising, undoubtedly, is *procrastination*.

Complacency is the mother of procrastination, and procrastination is the world's champion postponer of enterprise.

The time for you men to advertise is all the time. The time to start is NOW.

You may soft pedal a part of the time. You may burst forth into paeans when the need for business is more acute. But you should start now and keep at it with such varying degree of pressure as seems best.

Local business men, each doing business in a comparatively restricted territory, selling a standard product, have unusual selling problems. Likewise they have unusual selling opportunities. By pooling their ammunition, they can fire a cannon, rather than a broadside of pop-guns.

The problem of standardization of product taken care of, advertise that standard. Money spent in advertising a poor product is money sunk in the sea. Let us start with the assumption that each of you not only has a worthy product, but that the product is fairly well standardized.

Your job is to sell the standard products. It is not essential that they be sold on a price basis. No matter what you are selling, if it is actually worth more than other materials offered for a similar purpose, get more for it. That is a test of salesmanship. If you actually believe and can prove that your product is worth more, get more for it. If you can't get more for it, some doubt is cast upon your statement that it is actually worth more.

In selling your product, you must sell it broadly. Selling doesn't mean order-taking. Selling means the process of education—it means securing conviction to the point of impelling action.

You have three factors—many times four— in the process of selling a building material to go into, we'll say, a factory structure.

First, you have the professional man who specifies the materials, the counselor who is retained by the owner for expert advice—namely, the architect, the engineer, or both.

Second, you have the man who actually buys your stuff, the contractor.

Third, you have the ultimate consumer who eventually foots the bill, the owner.

And, in an increasing number of instances, you have the retail dealer through whom the material passes on its journey from the manufacturer to the construction site—the retail building supply dealer.

All of these factors are interested in the merit of your product. Each is interested in a different way. Each will ask different questions. Each requires different treatment, whether you are talking to the man face to face or endeavoring to impress him by the various forms of advertising.

Your job is to sell these people your product. Advertising is one of the methods used to complete a sale. It is not Magic. It will not work miracles. You can't advertise and sit in your chair and wait for the business to come in the door. You should use advertising by fitting it nicely with your other selling effort.

Now, before we consider how to tell the story, let us examine the story itself.

It would be perfectly possible for each one of you to organize a modest local advertising campaign, using the material that you have readily at hand. Such advertising could be made very effective. If persisted in, it will build up an asset of goodwill that would be like money in the bank.

You have many excellent advertising media to use. No one of them will do the whole trick. Not all have to be used at one time. No matter how many are used, the story should be hooked up. It should have sustained interest. Your advertising should be coherent—each medium you use should be made to fit with and to support every other medium that you use.

Obviously, the local newspaper will appeal to you first, because its circulation is largely, if not entirely, confined to the territory in which you do business. It reaches all factors in the sale of your product, so your appeal must be fairly general. Your story must be written to interest architect, engineer, contractor, dealer, and the general public. The general public includes not only prospective home owners, but also public officials who influence the construction of public buildings, industrial corporations who are large buyers of construction materials, railway officials, and business men who are in the boards of directors of institutions, such as hospitals, schools, libraries, museums, memorials, and so on.

All these may be effectively reached through the newspaper.

Remember the most important factor in the success of any advertising campaign—*continuity*. It is better to do a little advertising every week in the year than to do twice as much advertising for half a year.

Copy should be written with absolute clarity. Remember that you know your proposition better than anyone else, and are likely to slip into the use of terms and phrases that mean a lot to you but not a solitary thing to the average reader.

Use an illustration of some sort, to attract attention. A picture conveys an idea much more quickly than words. Use photographs where photographs tell a real story. Use a drawing, if that serves better. If you have nothing else for an illustration, use a cut of your trade mark or have your firm name lettered in some distinctive way. Don't use too many words—use plenty of white space in your copy. No matter how much or how little money you spend, stretch it out—make it work for you all the time. Remember the ten-million-dollar asset that Royal Baking Powder built up with the two-inch advertisements, run continuously.

Schedule your insertions for those days when the editorial contents of the paper lead people to think of building. If the paper runs a building page once a week, advertise in that issue.

Your product has certain important fireproof qualities. Why not get up a standard advertisement starting something like this. "Yesterday's fire would have been a harmless thing if the buildings had been built of——."

Leave a standing order with the newspaper to run that advertisement on the next day following any important fire. That brings the fireproof qualities of your goods to the mind of the public at the very time when the folly of using burnable construction materials has been impressed upon them. Such an advertisement has added *news* value—it's more likely to be read.

Plan your advertising so the newspaper always has copy when it needs it. Never publish "This space reserved for the —— Building Block Co." That's waste—it's waste occasioned by lazy advertising methods.

Bill boards can be hooked up to your newspaper advertising. Your local bill posting company can give you prices on boards for certain locations. Tell the story on boards largely with pictures. Use very few words—people driving along a street haven't time to *read* much on a bill board—they do have time to *see* much, and it's a time when their minds are not engaged with any other matters.

It is important not only to sell the architect (and the engineer) on the virtues of your product, but also to KEEP him sold. That's true of all advertising—one of its most important functions is to keep our friends sold on us and our wares. It is just as important to retain a present customer as it is to secure a new one. Don't assume that your present trade will always stay by you. Do something to keep your present customers sold.

Selling the architect is not always an easy job. He is a technically trained expert, and generalities do not impress him. He wants facts. He is an artist, and he wants the facts artistically demonstrated. He may not be interested in the facts when you present them—therefore, he wants them presented in such form as will enable him to file them easily, where he can find them when the need arises.

Send him definite specifications of your product—weights, measurements, strength, and so on. Back up your statements with tests. Have your printed matter for architects carefully done, don't send anything "cheap." Don't send too much at one time. Compile a list of architects, and mail something to that list at least once a month—maybe oftener. If he will accept it, place a specimen block in his office. Have it there so he may show it to his clients and to the contractors who are figuring on his jobs.

Send the architect pictures of buildings—he's always interested in them. Always give the name of the architect whose job it was. He is impressed by what his brother architects are doing.

Handle the contractor by mail. Get a mailing list and keep it up-to-date. Nothing wastes money faster than an out-of-date mailing list.

Some ofthe material you send to architects may also be sent to contractors. Remember that the contractor is interested first in putting up a *good* job and second in *saving money* on it. That doesn't mean making a *price* appeal. It means making a *cost* appeal. Show him how the use of your units can cut his costs in various ways. Detail these items to him, recount instances where these costs have actually been cut. Give names and dates and places. Make him understand that generally what another contractor can save, HE can save. Watch construction news, placing special pressure upon builders who are known to be figuring on jobs.

Your printed matter should be varied, today a mailing card, next week a folder, next month a booklet. Take particular pains with illustrations.

Use form letters. These may be successfully used on builders and upon owners. Make them full of interesting information. Have them look well typographically. Make them interesting. Keep driving your story home, varying the form of it. Constant reiteration of an idea will often sell it when nothing else will.

The use of street car cards is similar to the use of poster boards. You can use more wording, for the reader who has more time to read it. The picture is the important thing, however. Your local street car company can put you in touch with the agency handling the car cards. In large cities, a careful study should be made of sections where building activity is greatest. Then your car card campaign can be concentrated in the cars serving these sections.

As near the business center of your city as possible, an exhibition wall should be erected, with a suitable sign on it. You have these walls at your plant, but stick one downtown where the maximum number of people will see it.

Little need be said about exhibits at building shows, county fairs, and other like expositions. Your exhibit should involve an actual wall section and as many good photographs as you can provide. Suitable printed matter should, of course, be provided for those who want to carry away something.

Of course, every job on which your product is used should have a suitable sign on it. Such signs are generally carelessly placed. It is worth while to place the sign where the most people will see it. Use on the sign a picture, a trade-mark, or something distinctive—some illustrations that you have used in a little different form perhaps in your newspaper advertising, your circulars, your car cards.

Every truck that hauls your stuff should have a similar sign on it. Painting your trucks a distinctive color is in itself good advertising. Adoption of a distinctive color to use, whenever you use color in any of your advertising, is a good idea.

Contracts for Purchase of Cement

By Leslie Childs

Contracts for the sale of material, that have named a given quantity followed by the words "more or less," have been a prolific source of litigation. Disputes of this kind have usually involved the question of whether the amount named in the contract should prevail in fixing the maximum of delivery, or the needs of the buyer. Needless to say, each case of this kind has necessarily been decided in the light of the particular facts involved, which precluded the statement of a general rule that would apply in all cases.

However, generally speaking, where contracts of this kind specify the use to which the buyer is to put the material, which is followed by a named amount, "more or less," the buyer will, according to much authority, have the right to delivery of sufficient material for his needs upon the work named. In other words, the needs of the buyer will prevail, in fixing the amount of delivery, over the specification of quantity in the contract. This rule of construction is illustrated in an interesting and instructive manner in Sherman M. & I. Works vs. Carey, Lombard, Young & Co., an Oklahoma case reported in 227 Pac. 110, and is well worth a brief review.

Facts in the Case

In this case, the buyer had need of a large quantity of cement for use in a certain contract it had undertaken. Pursuant to this need, it entered into a contract with the seller for the purchase of this cement. This contract, in so far as material here provided as follows:

> First: The seller sells and the buyer buys * * * 600 bbls. (more or less) O.K. Portland cement * * * at $3.82 per barrel. * * *
>
> Second: The cement herein bought is for the exclusive use in the following described work:
>
> Waterworks Improvement and Filtration Plant, Lindsay, Okla. * * *
>
> The buyer hereby represents that he now has a contract to do the work specified; and in consideration of the special conditions upon which the cement is sold, the buyer agrees that none of said cement shall be resold or loaned or used for any purpose other than those herein specified, and the buyer further agrees that no other brand of cement will be substituted in the work above specified.

Pursuant to this contract, the seller furnished 788 bbls. of cement at the contract price. At this point, the company from which the seller was obtaining the cement raised the price to the seller to $4.41 per bbl. The seller thereupon added 20 cents to this price and proposed charging the buyer $4.61 per bbl. The buyer did not, it appears, agree to this increased price, though there was some correspondence between them about it.

The seller, however, continued to furnish the cement until about 129 additional barrels had been shipped, which, it appears, was sufficient to complete the buyer's contract. The buyer then declined to pay more than the contract price for this additional cement, namely $3.82 per bbl., and the seller brought suit to collect the difference.

This then raised the question of whether or not, under the contract, which specified 600 bbls more or less for use on the named work, the seller was bound to furnish sufficient cement for the seller to complete the work, or was the furnishing of the 788 bbls. a reasonable compliance with the contract. The seller contended that in furnishing 788 bbls. it had complied with the contract. The buyer took the position that, since the contract specified the work upon which the cement was to be used, it was entitled to the amount required at the contract price, regardless of the stipulation for 600 bbls. more or less. In passing upon this question, in the light of the terms of the contract, the court, among other things, said:

> Where the purchase is for a specific purpose and for a particular individual to be used for a certain and definite purpose, all of which facts are made known to the seller, and especially in contracts such as the one with which we are now dealing, wherein the purchasers agree to use no other brand of cement in the construction of the plant which he has agreed to build then that brand of cement manufactured or furnished by the seller, then the amount of material necessary to complete the job or contract of the purchaser becomes the essence of the contract, rather than the specification, wherein a certain amount of material is designated, more or less. * * *

Following the above statement, of its view of the proper construction of the contract of sale in question, the court, in conclusion, said:

> We think, under the terms of this contract, the defendant buyer was entitled to all the cement of the brand specified in the contract, and at the price specified in the contract necessary to complete the waterworks improvement and filtration plant at Lindsay, Okla. * * * *

The foregoing case is one of force and value on the point decided, as an illustration of judicial reasoning in the construction of contracts of this kind. Because of the facts involved, the decision is one of interest and importance to contractors, builders, and material men in general, as it exemplifies the legal significance of a contract of this kind to all parties concerned. Truly, the facts and holding of this case, when taken in connection with the contract involved, may with profit be held in mind by construction and material men in general, when a contract for a certain amount of material "more or less," is being entered into.

Friction Tests of Concrete on Various Sub-Bases

By A. T. Goldbeck
Chief, Division of Tests, United States Bureau of Public Roads

From *Public Roads.*

The rational design of any structure, whether it be a bridge or a pavement, necessitates a knowledge of the stresses to which it will be subjected. In a framed structure, stress analysis is comparatively simple, and may be made with practical surety. When one attempts however, to analyze a concrete road slab, a bewildering maze of uncertain forces is found. The uncertainty lies not so much in not knowing what forces exist as in an almost total lack of knowledge regarding their magnitude. We know that a concrete road slab is acted upon by forces which tend to slide it along its supporting base, which bend it, warp it, subject it to direct compression or tension, or to a combination of direct stresses and bending, forces of shear which tend to abrade its surface, and disrupting forces which weaken it locally. The series of tests discussed in this article was made to throw light on at least one of the forces acting on concrete roads, namely, the force of friction at the base.

It has been shown by several investigators that concrete elongates and shortens due to two principal phenomena; change in temperature and change in moisture content. A coefficient of 0.0000055 per degree Fahrenheit seems to accurately express the effect of temperature change. Tests[1] made on a number of large specimens of concrete demonstrate that moisture also plays an important part in influencing the length of concrete structures. Measurements made on new concrete after hardening, and repeated at a later date, indicate that drying out may cause a shrinkage of as much as 0.06%, while specimens kept in a moist condition may expand 0.01%. Both old and new concrete, if subjected to alternately wet and dry conditions must, inevitably expand and contract. Carefully conducted field measurements,[2] made with a specially designed instrument, corroborate laboratory measurements and show that concrete pavements are subjected to considerable motion over their sub-base.

Determination of Frictional Resistance a Step Toward Rational Design of Concrete Pavements.

Heavy masses of concrete can not be slid over the ground without considerable frictional resistance which will vary with the kind and conditions of sub-bases. In order to study the effect of the movement of pavements on the internal stresses developed, let a hypothetical case be considered in which the pavement after being laid is subjected to a rise in temperature and, in addition, due to weather and subbase conditions, is not allowed to dry out. Such a pavement will necessarily expand, and the ends of the slab will move away from the center. Friction will act to resist this movement and in this way becomes an external force, producing almost direct compression in the concrete. Should the frictional resistance exceed the compressive strength of the concrete, a compression failure will result.

Assume another case in which the temperature decreases considerably after the laying of the pavement, and let the concrete dry out, due to dry weather and a well-drained sub-base. This concrete will shrink, and the ends of the slab will approach its center. Friction will act against the movement, and tension will be produced in the concrete. Concrete is weak in tensile resistance, and not much shrinkage is required to crack the pavement if the sub-base is very rough. From these considerations, it will be recognized that as a step toward the rational design of concrete pavements the determination of frictional resistance at the base is necessary, and the following investigation was made with this in view.

Description of Specimens and Method of Tests

The bases of concrete roads have been of varying character. Loam, clay, old macadam, gravel, sand, and many other kinds of material support the concrete, and some offer more frictional resistance than others. In planning the series of tests, therefore, a number of different bases were used. Shallow ditches, 6 in. deep, 3 ft. wide, and 7 ft. long, were first dug in clay soil at the Arlington Experimental Station of the Bureau of Public Roads. Filling material forming the sub-bases was then deposited, tamped solidly, and smoothed or otherwise treated in readiness for placing the concrete. Upon the sub-bases, slabs were cast, 2 ft. wide, 6 ft. long, and 6 in. thick, of 1:1½:3 concrete, machine mixed, of medium wet consistency. The various sub-bases prepared were as follows:

A. Clay, smooth top surface.
B. Clay with cobblestones partly rolled in surface.
C. Broken stone, ¾ in. to dust, flat top surface.
D. Concrete base, top surface troweled smooth.
E. Loam, smooth top surface.
F. Sand, top surface smoothed and oiled with heavy flux oil.
G. Clay, surface scored to make it uneven.
H. Gravel, ¾ in. to ¼ in., flat surface.
I. Broken stone, 3 in.
J. Concrete base, troweled surface, oiled with heavy flux oil.
K. Sand, surface smooth.
L. Clay, oiled with heavy flux oil.

The first set of tests was made when the specimens were one month old. A frame made of a piece of ½-in. round steel, bent to surround the specimen, was fastened to the pulling chain, which in turn was linked to a spring dynamometer. Force was applied by means of a light steel rail used as a long lever. Two men at the end of the lever were able to apply a constantly increasing force with great steadiness. The movements of the slab were read by means of a Berry strain gauge, and in this way the movements corresponding to the force applied as indicated by the dynamometer were obtained.

The forces required to slide the specimens, together with their corresponding movements, are shown in the diagram. Each specimen weighed approximately 870 lb. The ground during these tests was damp but very firm. It will be noted that movement takes place almost as soon as the load is applied in all cases except that in which large broken stone was used in the base. Here there is great friction from the start until finally, when a load of 1000 lb. is reached, slipping begins to take place. Great force was required to start the slab, after which no more was necessary than in some of the other bases. Apparently the coefficient of friction is not constant but varies with the displacement. When the slab on the loam base had been slid 0.035 in., the load was gradually released, and the return movement noted on the strain gauge. The sub-base seemed to behave in a somewhat elastic manner, as the slab actually recovered considerable of its forward movement. This can be accounted for only by the partial springing back of the

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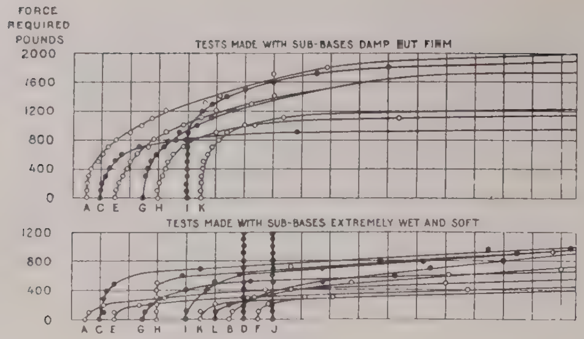
[1] The Expansion and Contraction of Concrete while Hardening, by A. T. Goldbeck, 1911 Proceedings of American Society for Testing Materials.

[2] See United States Department of Agriculture Bulletin No. 532, The Expansion and Contraction of Concrete and Concrete Roads.



Movement of Concrete Slabs on Various Sub-bases Due to Application of Horizontal Forces. Horizontal Divisions Represent Movements of Two One-Thousandths of an Inch. All Slabs Were 2 ft. Wide, 6 ins. Thick and Weighed 870 lbs.

sub-base towards its original position, carrying the slab along with it. The values of the frictional resistance offered at various displacements are given in Table 1.

Frictional Resistance Lowered by Wet Sub-base

The same specimens, and a few more that had been completed in the meantime, were again tested after a period of about a month and a half. During this interval, the ground was frozen solid almost all of the time, but the day before the tests, a thaw set in, and, combined with rain, served to make the ground exceedingly muddy. The bases of most of the specimens were thoroughly saturated with water, which stood on the surface in small puddles. The results obtained under such conditions are shown in the diagram, and it will be noted that the frictional resistance is considerably lower than it was in the previous tests. The water acted as a lubricant and permitted the slabs to slip easily. The values of the frictional resistance offered at various displacements are given in Table 2.

The results in the latter table, when compared with those given in the previous table, show very clearly that much depends upon the moisture condition of the sub-base. A wet sub-base permits the concrete to slide very much more easily than does a dry subbase. This apparently applies also to the specimens placed on broken stone and gravel bases, particularly when the movements are small.

Lowering Frictional Resistance Should Reduce Frequency of Transverse Cracks

In considering friction results, the maximum resistances are naturally of greatest importance, since these create the greatest stresses. Those given in the first table are therefore of more interest than those in the second, and these results very clearly show that the friction varies considerably, depending upon the character of the sub-base. The indications are that friction can be greatly decreased if proper care is given to the preparation of the sub-base. Every ridge or depression that is in the sub-base surface before concrete is deposited furnished an additional grip for the concrete, thereby tending to elastically deform a larger amount of base material, and thus offering greater resistance to the sliding of the concrete.

The formation of transverse cracks in the concrete bases can readily be ascribed to direct tension due to frictional resistance at a time when the concrete is contracting, whether this is caused by decrease in temperature or by drying out of the moisture. The test results show that the coefficient of friction can readily vary from almost 0 to something over 2 or more, depending upon the movement of the concrete and the character of the subbase. The distance between transverse cracks is dependent upon the coefficient of friction, and the total force of friction must extend over this distance. Calling the coefficient of friction f, the distance between cracks D, the weight of the pavement per sq. ft. w, we may write the equation: $f \times w \times D$ = tensile strength of concrete per ft. of width. Assuming the tensile strength of concrete to equal 100 lb. per sq. in., the pavement to be 6 in. in thickness, the weight of a cu. ft. of concrete to be 150 lb., and the coefficient of friction to equal 0.5, the equation is stated as follows:

$$0.5 \times 75 \times D = 72 \times 100, \text{ or } D = 185 \text{ ft.}$$

If the coefficient of friction equals 2, the distance between cracks becomes 46 ft. It is conceivable that conditions may exist in which the frictional resistance may mount much higher than this, and may be excessive in spots.

It is quite apparent from the above formula that, in order to reduce the frequency of transverse cracks, the subgrade must be made as smooth as possible and the concrete must be kept moist as long as practicable, in order to prevent tensile stress from being set up in the concrete before it has acquired high resistance to tension.

In order to try the effectiveness of a heavy oil coating for decreasing the friction at the sub-base, several specimens were made having sand, clay, and concrete sub-bases treated with a heavy flux oil. The oil was applied while hot, and was spread over the surfaces with a broom, in a layer of sufficient thickness to com-

Table I—Frictional Resistance of Concrete on Various Sub-bases in Damp But Firm Condition

Kind of Base	Movement	Force	Coefficient	Movement	Force	Coefficeint	Movement	Force	Coefficient
	Inches	Pounds		Inches	Pounds		Inches	Pounds	
Level clay	0.001	480	0.55	0.01	1,130	1.3	0.05	1,800	2.07
Uneven clay	0.001	500	0.57	0.01	1,120	1.29	0.05	1,800	2.07
Loam	0.001	300	0.34	0.01	1,030	1.18	0.05	1,800	2.07
Level sand	0.001	600	0.69	0.01	1,080	1.24	0.05	1,200	1.38
¾-in. gravel	0.001	450	0.52	0.01	960	1.10	0.05	1,100	1.26
¾-in. broken stone	0.001	380	0.44	0.01	800	0.92	0.05	950	1.09
3-in. broken stone	0.001	1,060	1.84	0.01	1,550	1.78	0.05	1,900	2.18

Table 2—Frictional Resistance of Concrete on Various Sub-bases in Thoroughly Saturated Condition with Water and Surrounding Ground Exceedingly Soft

Kind of Base	Movement	Force	Coefficient	Movement	Force	Coefficient	Movement	Force	Coefficient	Movement	Force	Coefficient
	Inches	Pounds		Inches	Force		Inches	Pounds		Inches	Pounds	
Level clay	0.001	120	0.14	0.01	300	0.35	0.05	500	0.58	1.5	950	1.09
Uneven clay	0.001	200	0.23	0.01	460	0.53	0.05	620	0.71	1.4	925	1.06
Loam	0.001	150	0.17	0.01	260	0.3	0.05	410	0.47	0.75	925	1.06
Level sand	0.001	140	0.16	0.01	280	0.32	0.05	400	0.46	0.75	875	1.00
¾-in. gravel	0.001	510	0.58	0.01	640	0.73	0.05	950	1.01	0.5	1,050	1.2
¾-in. broken stone	0.001	400	0.46	0.01	660	0.76	0.05	940	1.08	2.0	1,160	1.33
3-in. broken stone	0.001	240	0.28	0.01	630	0.73	0.05	900	1.04	0.875	1,625	1.87
Oiled clay	0.001	150	0.17	0.01	410	0.47	0.05	850	0.98	1.25	1,425	1.64
Clay and cobble stones	0.001	140	0.16	0.01	410	0.47	0.05	710	0.82	1.75	1,260	1.45
Concrete base	0.001	2,500+	2.9+	0.00	2,500+	2.9+	0.00	2,500+	2.9+	0.00	2,500+	2.9+
Sand, oiled	0.001	180	0.21	0.01	280	0.32	0.05	480	0.55	0.375	800	0.92
Concrete, oiled	0.000	2,500+	2.9+	0.00	2,500+	2.9+	0.00	2,500+	2.9+	0.00	2,500+	2.9+

pletely cover the sub-base. The concrete was deposited on these oiled bases immediately. So far as can be noticed, the oil is not effective in decreasing the friction in any of the bases, even when applied to the concrete base that had been carefully troweled smooth. It was impossible to slide the concrete specimen on the concrete base, even when a load of 2500 lb. was applied. No attempt was made to apply a greater load than this, because 2500 lb. was the limit of the dynamometer. When the maximum load had been reached for some of the specimens, it was slowly released, and the recovery of the specimen noted. In some instances, this amounted to almost ¼ in. It thus becomes evident that when the concrete slides over the sub-base, there is a considerable amount of yielding of the base material, and it is therefore to be expected that if the material is fairly homogeneous, and the movement of the concrete takes place slowly, the material of the sub-base will gradually yield under this movement, and will thereby offer less resistance than these tests seem to indicate.

Wet or Dry

CONCRETE is asked repeatedly which is to be preferred, dry tamp block or wet-cast block.

Many tests show that there is no material difference between the methods. In one case more water is used and in the other less water than would give the maximum strength which can be obtained for the same mixture. The point at which maximum strength can be obtained is unfortunately too dry for workability in the wet cast process and too wet for dry tamped products. This simply means that under identical conditions of manufacture outside of water content the more water used in the dry tamp method the greater the strength and the less water used in the wet cast process the greater the strength. In neither case can the ideal water content be obtained and in actual practice similar results are obtained by careful manufacturers using either method. See "Economical Manufacture of Quality Concrete Products," *Proceedings* American Concrete Institute, Vol. 20, p. 633 and CONCRETE, March, 1924, p. 120.

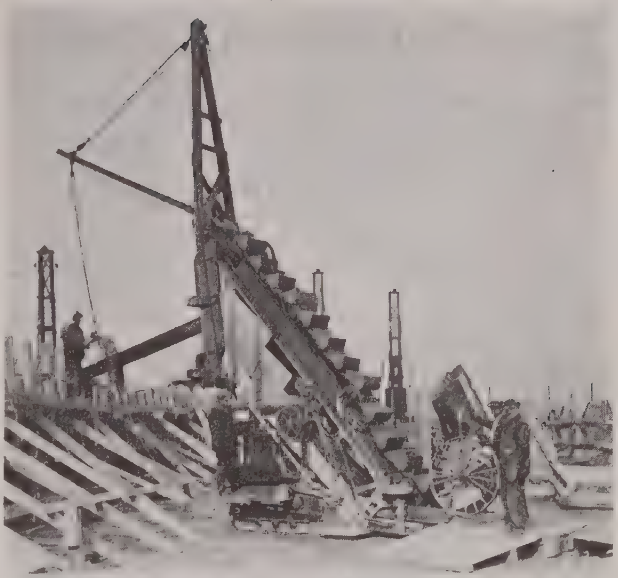
Bucket Loader Elevates Concrete

The pictures show the use of a bucket loader in placing concrete.

When the Empire Engineering Co. took the contract for building the foundation of the B. & O. Railway pier in Baltimore, a Barber-Greene self-feeding bucket loader was purchased to do the work of a tower system for the pouring of all concrete.

First of all, wooden piers were sunk 65 ft. deep, and left projecting a foot above water. On these, creosoted joints and cross planking formed the foundation for the concrete walls and columns, which, in turn, were to support the freight warehouse.

A crane, mounted on a barge, fed sand and gravel to a mixer, which discharged into a hopper on the pier. The concrete was then wheeled to another hopper at the foot of the bucket elevator on the loader. The patented double-disc feeder was removed to make room for this hopper. The loader then poured the concrete into the forms.



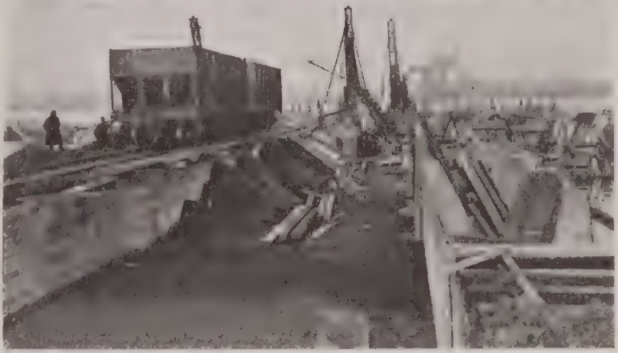


FIG. 1—BARBER-GREENE BUCKET LOADER ELEVATING CONCRETE FOR CHUTING INTO FORMS

FIG. 2—GENERAL VIEW OF WORK ON B. & O. RAILWAY PIER FOUNDATION

From January 4, when the job started, until the work was finished on April 22, 8965 cu. yds. of concrete were poured, the loader doing it all without a single breakdown. The equipment made it possible to finish the job in 80 working days—almost a month and a half ahead of schedule.

Many shifts were necessary, and the loader moved about easily from one position to another. In the elimination of carpenter's wages, and lumber for runways and by-passes, an estimated saving of several thousand dollars resulted, without considering the saving in time and the greater convenience.

Eugen Dyckerhoff, who has done as much for cement and concrete as any manufacturer in all the world, passed away, August 4, 1924, eighty years old. He was honorary president of the Deutschen Beton-Verein, and his title was "Herr Geheimer Kommerzienrath Dr. Ing, e. h. Eugen Dyckerhoff," from Biebrich am Rhein. Besides his manufacturing business, he was widely known as the organizer and leader of Dyckerhoff & Widmann A. G., reinforced concrete contractors.

Few men have had the peculiar magnetism and pleasant mannerism of this intrepid leader of a new cause. Eugen Dyckerhoff became president of the Deutschen Beton-Verein in 1899, two months after its founding, when the first president, Hartwig Grunder, suffered a sudden stroke of paralysis.

Until 1911, Dyckerhoff acted as president, and, owing to his age and many responsibilities was permitted to resign, and, on the 14th anniversary of the Verein, was unanimously elected to honorary presidency for life.

Cement Specifications

Comparison of French and American Specifications and Tests for Portland Cement

By Duff A. Abrams
Assisted by Stanton Walker and Albert Timms

The following notes point out the fundamental differences between the French and American specifications and tests for portland cement. The French specifications were formulated by a committee, formed in 1918, representing the government, manufacturers, architects, engineers, and contractors. These specifications have for their purpose the standardization of test methods, nomenclature, and conditions of acceptance of various types of hydraulic binders (limes and cements), and the reduction of the grades of material to a minimum, each having distinctive qualities, well defined with reference to their manufacture and uses. The American specifications are the "standard specifications and tests for portland cement" of the American Society for Testing Materials, adopted in 1921. They have been adopted as standard by other leading engineering societies, and approved in 1922 as "American Standard, No. 1" by the American Engineering Standards Committee.

The French specifications cover the general requirements for the following hydraulic binders:

(1) Artificial cements; (ordinarily called portland cements);
(2) Natural cements;
(3) Grappier cements; a by-product of the manufacture of lime;
(4) Mixed cements; a mixture of Grappier and natural or artificial cements;
(5) Puzzolan cements (including the slag cements);
(6) Hydraulic limes.

Many of the provisions of the French specifications are not mandatory unless so designated in separate contracts between the buyer and seller; but are of the nature of recommendations for quality and methods of test.

The following notes consider only the artificial cements. The word portland is used synonomously with artificial. In general, the arrangement of the sub-headings follows the order of the American specifications.

Definition. The French definition for artificial cement is the same as the American definition for portland cement, except that they allow the addition of 3% of foreign material subsequent to calcination, the nature of which is not specified; while the American specifications limit such additions to water and gypsum, and do not specify the quantity.

Chemical Limitations

The only chemical limitation mentioned by the French specifications is that sulfuric anhydride (SO_3) must not exceed 3%. Magnesia is discussed, but the soundness test is depended upon to detect harmful amounts of this compound. The American specifications limit sulfuric anhydride to 2% and magnesia to 5%. The methods for determining sulfuric anhydride are essentially the same in the two specifications.

Physical Properties

Specific Gravity is not mentioned in the French specifications.

Fineness. The French specifications limit the residue on a sieve having 324 meshes per sq. cm. to 1%. The wire for this sieve is specified as 0.2 mm. in diameter. This is equivalent to a 46-mesh sieve (clear openings 0.014 in.). The test is made with a 200-gm. sample. Failure to meet this requirement is cause for rejection. It will be noted that this requirement serves only to exclude cements containing unground clinker or other coarse material.

The American specifications limit the residue to 22% on a 200-mesh sieve (clear openings 0.0029 in.). A 50-gram sample is used.

Normal Consistency. The normal consistency of cement is determined by means of the Vicat needle. This apparatus is also used for the American test.

The French method of making the test differs from the American method in the following respects:

(1) The paste is mixed with a trowel for 5 min.; the American method requires that the water be incorporated with the cement within 30 sec., and that it then be kneaded with the hands for 1 min.

(2) Normal consistency requires the quantity of mixing water which will permit the needle to penetrate within 6 mm. of the bottom of the specimen. (Equivalent to penetration of 34 mm.) No time limit is set for the penetration of the needle. The American specifications require a penetration of 10 mm. in 30 sec.

Soundness. The French use the Le Chatelier method for the determination of soundness. This consists of measuring the swelling of a 30 x 30 mm. cylinder of neat cement of normal consistency. The measurement is made by means of needles 150 mm. long attached to the cylinder molds on either side of the slot. Two tests are made; one for 7 days in cold water, and one for 3 hours in boiling water. The movement of the needle points with relation to each other shall not exceed 10 mm. The specimens are immersed in water immediately after molding. Failure to meet these requirments is cause for rejection. In case of the presence of more than 3% of magnesia or any free sintered magnesia, the boiling test is continued 2 hours longer (total of 5 hours).

The American test for soundness consists of subjecting a standard pat of neat cement to steam at 98° to 100° C. for 5 hr., 24 hr. after molding. The pat shall remain firm and hard and show no signs of distortion, cracking, checking or disintegration.

Time of Setting is determined by means of the Vicat needle in both specifications. The French specifications cover only the initial time of setting, and give no limit to its value. The test is used to classify cements as quick, medium, slow, and extremely slow setting. Less than 5 min. is quick setting; 5 to 30 min., medium; 30 min. to 6 hr., slow; and over 6 hr., extremely slow.

The American specifications limit the inital set to not less than 45 min. and the final set to not more than 10 hr. for the Vicat method.

The French method of making the test differs from the American in the following respects:

(1) The paste used is wetter, due to the difference in the method of determining normal consistency. The method of mixing the cement paste differs also, as described above.

(2) The specimen is immersed in water at 15° C. immediately after molding, instead of being stored in a moist closet at 21° C.

(3) The initial set is said to have occurred when the needle no longer penetrates to the bottom of the specimen. In the American method the initial time of setting is the time when the needle penetrates to within 5 mm. of the bottom of the specimen in 30 sec. The American specifications also contain time of setting requirements, using the Gillmore needle.

Strength Tests. The French specifications for strength are based on tests of the briquet. Compression tests of 4 cm. cubes are recommended for the future, but no strength limits are set.

The strength limitations for the two specifications are somewhat difficult to compare, due to differences in grading of standard sand, the method of mixing the mortar, and the shape of the briquet. The methods of molding, curing, and testing the briquets are essentially the same as described in the American specifications.

The French standard sand consists of equal parts by weight of three sizes separated by means of sieves with round openings having diameters of 2, 1½, 1, and 0.5 mm. The limiting sizes are 0.078 and 0.020 in. The American standard sand consists of particles retained on a No. 30 sieve and passing a No. 20 (clear openings, 0.022 and 0.0335 in.).

The same differences in mixing the mortar exist as in the case of the neat cement described above.

The quantity of mixing water and consistency of mortar probably differ somewhat from those used in the American tests. A definite comparison cannot be made without knowing the exact relation between the normal consistencies determined by the two methods on the same cement and between the water requirements of the two sands.

The minimum cross section of the French briquets (5 sq. cm.) is only about three-quarters of the area of the American briquet, and it is larger at the ends. Cylindrical recesses on the sides of the briquet at the middle insure failure at that point.

Strength Requirements. French cements are classified according to their 7 and 28-day strengths. Following are the strengths for three grades of artificial cement:

Cement	Tensile Strength kg. per sq. cm. 7d.	 28d.	 lb. per sq. in. 7d.	 28d.
Standard portland	10	15	142	213
Cement for reinforced concrete	15	20	213	284
Cement for exceptional jobs	20	25	284	355

All packages of cements must have a tag showing the minimum tensile strength at 7 and 28 days.

Failure to meet the requirements of a given classification causes the cement to be reclassified in another grade.

The minimum requirements of the American specifications are 200 lb. per sq. in. at 7 days and 300 lb. at 28 days. However, as mentioned above, no direct comparison can be made of the strength requirements of the two specifications. It will be noted, however, that the *relative* strength at 7 days in the second and third group are much higher than required by the American specifications.

Packages, Marking, and Storage

The American specifications fix the weight of a sack of cement at 94 lb. and a barrel of cement at 376 lb. (net). The French, on the other hand, allow sacks to weigh either 25 or 50 kg. (55 or 110 lb.) and barrels 100 or 200 kg. (220 or 440 lb.). The French specifications make no provision for the storage of the cement to permit easy access for proper inspection and investigation. All sacks and barrels are required to be in perfect condition at time of delivery.

If tests are required, they shall be made at the expense of the buyer, 5 days after delivery. Tests of composite samples are not permitted. The barrels or sacks to be sampled are designated by the buyer. No provision is made for mill sampling.

Each package must carry a tag showing the minimum strength of the cement at 7 and 28 days.

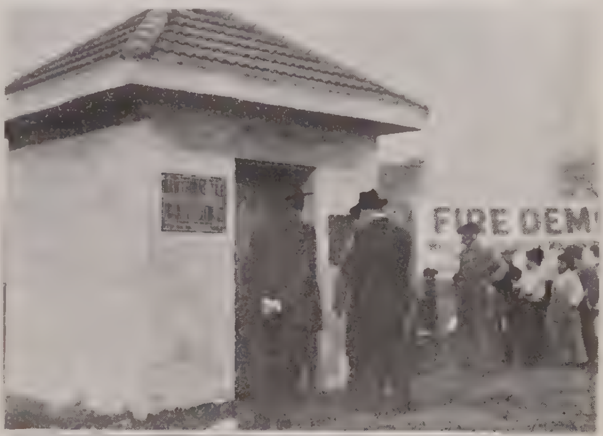
If the tests yield unfavorable results, the entire lot shall, according to the special terms of the contract, be rejected or classed in an inferior category.

Fire Demonstration of Concrete Block House

During National Fire Prevention Week the Greater Chicago Concrete Products Association built and tested a demonstration house at 5840 Ogden Avenue in Cicero. The building was 10 ft. square and built of 8-in. concrete block laid in cement mortar and the roof was covered with concrete roofing tile. The ceiling and eaves were protected with cement plaster on metal lath. On the day of the fire, Saturday, October 11th, the house was charged two-thirds full with pine and oak planks which were soaked with kerosene. To this was added 30 lbs. of pitch and 40 lbs. of oil soaked waste. The wooden trim in the building was soaked with kerosene. One of the windows was let down half way and the door left ajar so there would be a draft throughout the building and also to prevent an explosion when the fire was started.

The fire was under the personal direction of Fire Chief, Fred C. Haan of the Cicero Fire Department. The only instructions he had from the Greater Chicago Concrete Products Association was that the fire was to burn as long as he saw fit and certainly until it had reached it's maximum heat.

At 2:30 the Chief started the fire and instantly the building was a mass of flames due to the fact that it had ample draft and the inflammable parts were soaked with oil. The block and concrete roofing tile over the



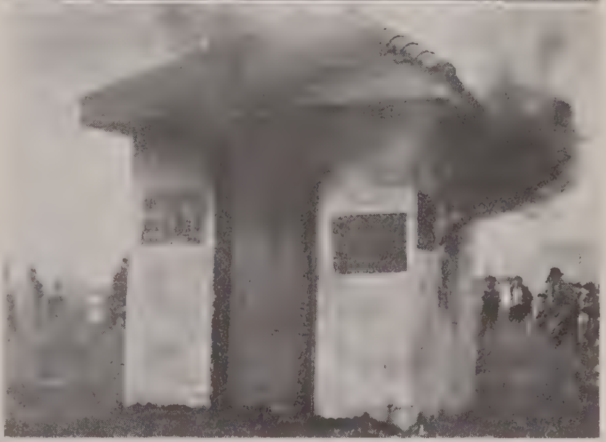


Fig. 1—Demonstration House Completed Ready for the Fire Test

Fig. 2—Immediately After Starting the Fire. The Door and One Window Were Left Open to Provide Draft

openings were subjected to continuous intense heat because the flames shot through the openings and up over the cornices and along the roof. When the fire chief was satisfied that the fire had reached it's maximum heat and most of the combustible material had been consumed he directed a hose stream at 60 lbs. pressure against the red hot block walls. The cloud of steam and smoke was so dense that the building could not be seen for several minutes.

When the building cooled down an extensive examination was made to determine the effect of the fire and water on the block and roofing tile. The result of this examination is best told in the words of the Fire Chief, whose letter follows:

> In connection with our Fire Prevention Week ceremonies a fire demonstration was held at 5840 Ogden Avenue, Cicero, on Saturday, October 11th at 2:30 p. m., conducted by the Greater Chicago Concrete Products Association and under my personal supervision.
>
> The demonstration building was constructed from tested concrete block laid in cement mortar. The roof was covered with concrete roofing tile manufactured by the Hawthorne Roofing Tile Co.
>
> The building was two-thirds filled with oak and pine planks. These were soaked with 15 gallons of kerosene. 30 lbs. of pitch and 40 lbs. of oil soaked waste were added. All wooden trim was soaked with kerosene. As soon as a match was applied all combustible material was instantly aflame and it was allowed to burn until the oil, pitch, waste and most of the wood had been consumed. The intensity of the fire was much greater than could be obtained in an ordinary residence fire and in my judgment must have reached 1500° F. Just after the fire had reached its maximum heat, a fire company directed a hose stream on the red hot walls and the roofing tile. The water was under 60 lbs. pressure. After the building had cooled off an examination showed that neither the block nor the roofing tile was injured by the fire and water in spite of the fact that the block and tile immediately above the openings were subjected to continuous intense heat.
>
> From this demonstration I am satisfied that homes and mercantile buildings built of concrete block masonry and covered with concrete roofing tile are highly fire resistive and will do much to reduce ou tremendous annual fire loss.

The Greater Chicago Concrete Products Association has spent thousands of dollars this year promoting concrete masonry construction and the results of this campaign can be measured first by the increased activity on the part of the concrete manufacturers themselves, second by the increased number of concrete masonry houses that have been built in the city of Chicago and in the suburbs, third by an appreciable change in the attitude of architects toward concrete masonry construction.

Still Another Special Concrete

Con-o-lite Corp., manufacturers of burial vaults, 31½ Main street, Cortland, N. Y., is manufacturing burial vaults from Con-o-lite, a material originated by W. E. Willett.

Con-o-lite is a patented article, and is made from 72-hour washed foundry coke, certain chemicals, and portland cement. Coke contains 98½% pure carbon, and only .5% sulfur. It is reduced in a jaw crusher, then through a roll crusher, and screened through ¼-in. screen. Certain chemicals are added to the coke, and the material is then mixed with portland cement in the proportions of 50%-50% by weight, which is equivalent to about 1:4½ by volume. The resulting product is called Con-o-lite. It has a hard, glass-like appearance, and Mr. Willett claims it is waterproof.

Vaults weigh 600 lbs. complete with cover, while Con-o-lite itself weighs about 45 lb. per cu. ft. The inventor also claims that the material can be plastered on in layers and perfect bond obtained.

Near East Relief Orphans Become Concrete Workers

Building conditions in the Near East have been revolutionized since the Near East Relief began training orphans under American care in modern methods of construction. One of the innovations is the substitution of concrete for the primitive mud houses found along the country side.

Since Bible days people in the outlying districts have been accustomed to building their houses of mud mixed with straw and covered with whitewash. For the roofs they used wooden logs topped with matting and mud. A necessity for every household was a mud roller used to flatten out the mud evenly on the housetops to prevent leaks after a heavy down pour of rain. This type of dwelling was neither warm, sanitary nor convenient, but in that part of the world custom plays a very important part. "What was good enough for our forefathers is good enough for us" was a common expression until American relief pointed a better way.

The 100,000 orphans that have been benefited by American philanthropy and trained in American methods of accomplishment are a big contributing factor in raising the standard of living in the Near East. Eventually this is bound to bring about a demand for American building supplies.

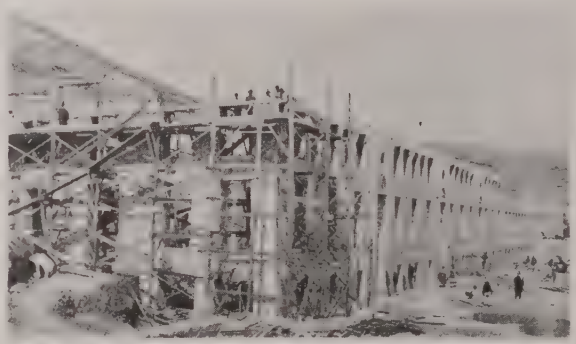


Fig. 1—Orphanage Under Construction in Syria

At the present time all but 40,000 of the orphans have either graduated into industry or been placed in homes. 60% of those remaining are under 12 years of age. Every child is given an industrial education in the trades most in demand such as carpentering, brick making, tailoring, tinsmithing, blacksmithing, pottery making and printing.

This training is carried on in two ways, by the apprenticeship method and by having trade schools in the orphanage—the manner of instruction depending on the conditions of the country where the orphanages are located. In the larger centers, where the industrial life has become normal the boys are apprenticed to skilled artisans for certain hours of the day and the remainder of the time devoted to book learning.

Of the 39 orphanage centers in Syria, Greece, Palestine and Russian Armenia now receiving support of the Near East Relief, all but one of the centers are comprised of buildings made over to suit orphanage purposes. They represent every type of structure from a monastery to a palace. The exception is at Syra where a Greek orphanage has been especially built to house 2,500 children brought out of Turkey during the exchange of populations. The children were homeless and lived in tents until the buildings were under way. The boys assisted the refugees in the erection of the orphanage dwellings. This naturally cut down the expense of building and at the same time gave the boys practical training. When the task of caring for the orphans is completed, Near East Relief plans to turn the buildings over to the Greek government as a trade school in memory of Woodrow Wilson, who was always much interested in the Near East.

It was at Syra that the boys received their first lessons in concrete construction, for all the foundations of the buildings are of concrete. The reinforcement work was all done by orphan blacksmiths under the direction of native laborers.

In order that the Near East Relief may continue its work, it is proposed to observe Sunday, December 7, as International Golden Rule Sunday as a means of providing for the orphans and at the same time to establish a bond of universal brotherhood among all people. On the first Sunday in December we are asked to eat a simple meal such as is served every day in Near East Relief orphanages and make a thank offering to the Near East Relief for the support of the dependent children. President Calvin Coolidge sponsors the idea which grew out of a conference held in Geneva, Switzerland, two years ago when philanthropists from twenty countries were considering the perplexing problems of the Near East.

For further information concerning the observance of Golden Rule Sunday address International Golden Rule Headquarters, 151 Fifth Avenue, New York City.

Some Interesting Flat-Slab Details From Germany

Extracts from Dr.-Ing. A. Spilker in *Der Bauingenieur*, by E. Lee Heidenreich

Figures 1 and 2 must attract an engineer's attention, on account of the peculiarity of form and the hooked ends of the reinforcement, both in floor and column rods. The illustrations are from a boiler house in Elverlingsen, Germany. The text gives a view of the German aspect of flat slab floors rather different from the accepted considerations in our several rules and regulations for these structures, as the following extract will indicate:

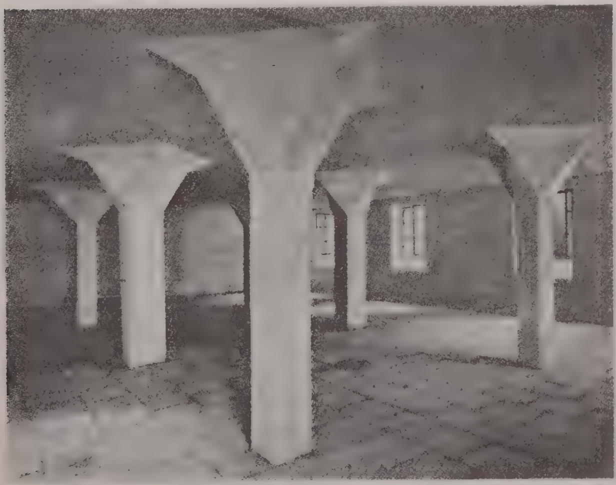


Fig. 1—Flat Slab Floor with Mushroom-Like Column Heads

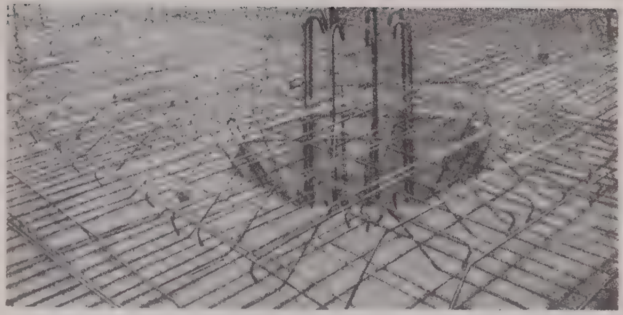


Fig. 2—Reinforcement of Floor Slab Over Column Head

As in flat slab floors, the greatest stresses, bending moments, and shear forces occur near the supports, the floor construction here is strengthened, thereby forming mushroom-like column heads, from which originates the name of *mushroom floors*.

From a point of design, these heads should have the largest extension practicable, combined with the softest approach to the underside of the floor. The size of the head is limited, partly by its cost and partly by economy of space, as well as by appearance, against which considerations stands the reduction of bending moments.

We have, in Germany, no recognized rules for flat floors, and the calculations presented to the authorities are more or less vague and uncertain. We have the method of Dr. Lewe, who solves his problems by means of the Fouriers progressions, and the theory of the elastic mat of Marcus, which is the basis of calculations for the floor here shown.

The positive moments in the panels and between the columns were reduced by the extension of the column heads, the increase of the moment of inertia approaching the columns, and finally the fixed floor condition at the columns, which connects or joins the floors and the columns into rigid frames, a consideration which extends the negative moments above the supports further than if only plain columns were considered.

At the instance of Marcus, the German authorities for reinforced concrete have agreed to test finished flat slab floors, designed according to his method, and thereby ascertain its value as a basis for future designs. The economy of the flat slab construction deserves rigid investigation of its apparent strength and economical value.

Old Viaduct in France Renovated by the Cement Gun

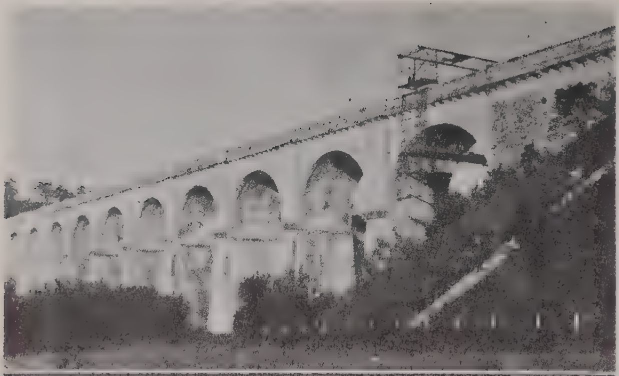
M. Julien in "*Le Ciment*," extract by E. Lee Heidenreich

The Bauzanne viaduct, on the line from Chateauroux to Limoges, is built in 30 arch spans, of 52 ft. each, and was erected in 1848 to 1851 the material being found locally. Due to repeated frosts and constant action of the elements, the surfaces had deteriorated to such an extent that repairs were absolutely necessary.

The cement gun was selected as the most promising method, as it had been employed with success in a number of places where rapidity and economy were the first requirements.

Fig. 1 shows the elevation of the viaduct before being repaired.

In all of the most pronounced cavities or cracks, metallic reinforcements first were driven into the joints or fissures. Then, by means of the cement gun, Fig. 2, a covering of about 1¼ in. of rich mortar was forced against the surface and into all crevices, the mixture being 1¾ bbls. cement per cu. yd. of sand.



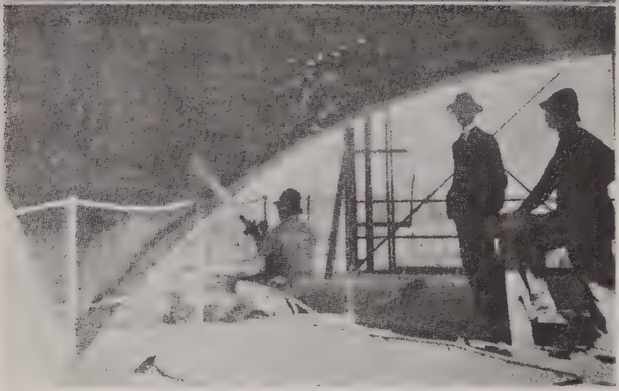


Fig. 1—Elevation of Viaduct Before Completion of Repairs
Fig. 2—Applying Gunite to Under Side of Arch

At the most defective arches, it was found necessary to apply up to 14 or 15 layers of mortar successively, before the renovation was considered complete, which made the work last from October 16 to November 12, 1921, and then each year during clement weather, until it is now finally completed.

This employment of the cement gun has been a revelation in many quarters, and it looks as though this experience will readily be repeated in France—and why not in the many highways of the United States, where the lack of knowledge has left thousands of otherwise well-constructed concrete bridges with unsightly expansion cracks as well as pitted surfaces?

German Warning Against Keene's Cement in Concrete Tiles

An article in *Zement* recently called attention to the concrete tile industry as compared with burned clay tile for floors, wainscoting, stairs, bathrooms, etc., as well as polished terrazzo tiles. In the latter is used, in addition to portland cement, marble chips and dust, crushed mother-of-pearl, and glass, and they may be formed in a great variety of shapes and styles.

Concrete tiles for these purposes have the great advantage over burned clay tiles that they may be produced in larger sizes without warping, cheapening the construction by using fewer pieces per sq. yd of surface to be treated. For granitoid sidewalks in Germany, millions of squares are spread over the entire country. By the use of crushed granite, basalt or flint, the surface of these sidewalks becomes as hard as steel and stands a remarkable wear and tear.

These tiles usually are 12 in. to 18 in. square, and 1¼ in. to 2 in. thick, and have lasted more than thirty years, when properly laid, and it is a common saying that the most expensive granitoid tile is cheaper than the average burned tile.

The artificial marble tiles, granitoid tiles, and terrazzo are preferably poured face down, that is, the finished surface is in the bottom of the mold, and, if the coloring matter is not already mixed with the cement, it is applied in liquid form on top of the mass and soaks through.

The United Marbleite Co., in Tulsa, Okla., uses a similar method for its artificial marble, which in the process of making receives a glossy finished surface. The German manufacturers supply the glossy appearance by grinding the surface after the tile has hardened, adding water in the process.

Granitoid tiles are made under a pressure of 250 tons to the tile, produced by a hydraulic press.

Dr. Haegermann writes in *Zement*, that time and again he has found defective tiles of imitation marble, and after careful research, found it due to the use of Keene's cement, also named marble cement, as this cement does not work in conjunction with portland cement. Dr. Haegermann advises the public to stick to portland cement and finely ground quartz.

"Korrelbeton" in Holland

From "Zement," by E. Lee Heidenreich

Ever since the war, the scarcity of dwelling houses has occupied both the government and the public mind of Holland. Finally, the Dutch architect, Mr. Greve, presented a new building material as well as an improved method of construction, using the so-called Korrelbeton.

The Korrelbeton consists of portland cement and aggregates of blast furnace slag, broken bricks, coarse ashes from coke and other sharp-cornered substances, without any fine aggregates, such as sand. These aggregates are of a size up to ½ in. cube. For walls, one part cement to ten parts of aggregate is used, which results in a light substance with 30% to 50% voids, giving a very good insulation against temperature changes, as well as, it is claimed, a water proof and moisture proof wall, into which nails and spikes are readily driven. These walls are plastered for appearance only, not for any waterproofing purposes.

The floors are made from the same material, but with sand added, and the mix here is 1:5 up to 1:3, for the sake of strength.

The new method of construction consists in the use of forms in standard units, made from wooden frames and sheet metal panels. These forms are set up for each floor independently of sub- or superstructure, in such manner that a number of houses are built simultaneously by successively moving the forms of one story to the next building as soon as the concrete is sufficiently set for the removal of the sheet iron panels, while the wooden frames may be retained as braces for a time.

It has been found that the actual saving by this construction as against brick building is in excess of 20%.

Concrete Pipe Sewers

In the September issue of Concrete it was erroneously stated that the very informative bulletin, *Concrete Pipe Sewers*, was published by the Portland Cement Association. It was issued by the American Concrete Pipe Association.

Graded Aggregate

Highway Fellowships

The Board of Regents of the University of Michigan will award Highway Engineering and Highway Transport Fellowships as follows: The Roy D. Chapin Fellowship in Highway Transport, which is offered to provide for the investigation of an approved subject relative to highway transport.

The Roy D. Chapin Fellowship in Highway Engineering, which is offered to provide for the investigation of an approved subject relative to hard-surfaced roads and pavements.

Two Detroit Edison Fellowships in Highway Engineering, which are offered to provide for the investigation of approved subjects relative to moderate cost country roads. Each Fellowship pays the sum of $250 with an allowance of $50 for expenses. Fellows do not have to pay tuition fees. A Fellow must hold a Bachelor's Degree from a college of recognized standing. He must enroll as a graduate student in highway engineering or highway transport, and as a candidate for the degree of Master of Science or Master of Science in Engineering.

* * *

Suction in Brick

As to concrete brick making, there have been numerous inquiries on the subject of absorption. Absorptiveness is a great aid to the mason. A brick that is too dense frequently slips or "floats" when a few courses are in place. A correspondent says:

> Suction undoubtedly governs to a considerable extent the speed with which brick masonry can be laid, the tenacity with which the mortar will hold to the units and the ease with which the mason can place the brick in the wall. Soft clay brick have a great deal of suction because the absorption often runs from 10 to 30%. Hard burned clay brick are not so well liked by the masons, are slower to lay and are customarily laid in cement mortar. They are used only where appearance is a consideration. Any mason will readily admit that the hard burned product is much harder to lay because of its density. Early manufacturers of concrete brick often assumed that the best brick was the most dense brick. Working on this assumption they employed rich mixtures and not infrequently produced brick which would slide in the wall, slowing up construction and making it impossible to lay more than a few courses until the mortar had hardened. This was particularly true of brick made by the wet cast process.
>
> The most successful concrete common brick has rather high absorption for concrete—usually 8 to 15%—but the result is fast laying and the strengths are usually kept low enough to insure easy cutting although still sufficient to permit rough handling and to sustain all necessary loads.
>
> There need be no fear of moisture getting through a wall of concrete brick made in units having an absorption of 15%—at least that would seem a reasonable assumption in view of the apparently satisfactory use of 30% clay brick—as for instance in Chicago.
>
> The fear is occasionally expressed that unless brick are very dense the moisture will be drawn from the mortar to such a degree that the bond may be impaired. Such a result is not at all likely. Dry brick of great ability to absorb seem to make the very best base for stucco and there is little doubt that they have an equal advantage when laid in mortar. The suction of the brick seems to draw the moisture; the moisture carries with it small particles of cement and this film not only keys into the brick but effectually prevents the further passage of the moisture from the stucco or mortar.
>
> From observations of stucco over a considerable period there appears to be no reason to worry about pulling moisture from the stucco into the concrete base. Care must be taken however, to place stucco where the wind and sun can get to it for these agents undoubtedly have the power to withdraw moisture very rapidly.
>
> I note that the above subject has been discussed with you by a man manufacturing concrete brick by a method which makes a rather dense product. Possibly the manufacturer uses wet molds. There has been quite a little difficulty with wet molded brick from sliding in the walls due not only to low absorption but to the burnished surfaces. The cast brick are very pretty, being much more perfect in appearance than the tamped product. Some cast brick are much higher in absorption than their predecessors.

* * *

Electric Strain Gage for Study of Mass Concrete

In cooperation with Engineering Foundation, the design of a carbon resistor cartridge for measuring deformation in mass concrete has been undertaken by the Bureau of Standards, with particular reference to the study of arch dams. A design has been completed and an experimental cartridge made up, which is now being given a series of laboratory trials to determine temperature and other effects. It is planned to make up a number of these cartridges and embed them in concrete, with a view to determining the effects of shrinkage and other factors as an aid to intepreting results obtained in field work.

* * *

What Is a Brick

At the instigation of the Common Brick Manufacturers' Association of America, the National Vigilance Committee, which is a department of Associated Advertising Clubs of the World, issued a bulletin in which it defines the word brick as "a solid burned clay product of dimensions approximating 2¼ x 3¾ x 8 in." In commenting on the bulletin issued by the Vigilance Committee, the weekly newsletter of the Common Brick Manufacturers' Association says, "the bulletin will establish with publications throughout the country the principle that no commodity should be advertised as brick, using the word alone, unless it is made of burned clay, and that all advertising for substitutes should clearly set forth that the building unit is made of some other material than clay." A definition is something, anyway. But a definition doesn't show as high a ratio of pier to unit strength as concrete brick for instance. See Columbia University Tests.

* * *

Colorless Waterproofing

Someone asks about colorless, non-staining waterproofing for use on red clay brick, and the following from another correspondent may interest others:

> As to discoloration produced on red brick by outside waterproofing materials: those materials consisting of paraffin and China wood oil solutions produce an oily appearance which is quite pronounced on porous surfaces and less so on dense surfaces. This gradually disappears and at the end of a year or two the surface so treated will appear cleaner than the untreated, due to the fact that dust and soot do not cling to the surface so readily.
>
> Materials which do not produce an initial discoloration consist of aluminum stearate solutions. The latter type of treatment is not as durable as the former.

* * *

Living Costs

Living costs decreased 20.9% from July, 1920, to July, 1924, according to the National Industrial Conference Board. Between March 15 and July 15, 1924, there was an average decrease of 9/10 of 1%. The purchasing value of the dollar, based on the cost of living in July, 1924, was 61.8c, as contrasted with one dollar in July, 1914.

Engineering Advice at Capital

President Harold Almert, of the American Association of Engineers, headed a delegation of officers and representatives of that organization, early in September, in a call on President Coolidge and Secretary Hoover.

The President was informed of the aims and objects of the Association, and the establishment of a new Washington office as an aid to the President and Congress, as well as the engineering profession. He was told of such major national activities of the Association as fuel economies and highway safety, and that the Washington office of the Association was available as a fact-finding agency and clearing house on questions involving engineers and engineering.

It was explained that the Association, because of its widely scattered chapters, was in a position to guide or influence intelligent public opinion to a better understanding of the problems of water power development, of fuel, of transportation, and of the infinite variety of engineering devices upon which modern society has become dependent. Secretary Hoover thought that the national program of the Association on fuel economics was the most worthy civic activity the Association could undertake and he heartily endorsed it.

* * *

Data on Structural Material

Values of the strength of pure metals and their alloys and of wood are given in the revised edition of the Bureau of Standards circular on the physical properties of materials. (Bureau of Standards Circular 101, *Physical Properties of Materials;* copies from the Superintendent of Documents, Washington, D. C., for 40c.) The information given is compiled from various sources, including tests made at the Bureau of Standards. The data on wood are taken from Bulletin 556 of the United States Forest Service, Department of Agriculture. Most of this material has been available before, but in such a scattered form that considerable searching might be required to secure necessary information. The first edition was issued in 1921. The present edition contains a large amount of new material, much of which has been published since that time.

* * *

Mineralized Sawdust

In the article "Mineralized Sawdust Aggregate for Concrete," on page 106 of the September issue of CONCRETE, it is stated that during the fire tests on Novocrete, the temperature was raised to 700° F. in one hour; this should have read that the temperature was raised to 1700° F. in one hour. And in the following paragraph the last sentence should have been: "Both samples were then immersed in water, and at the expiration of four days, the results showed a greater coefficient of contraction of sand and cement than of Novocrete."

* * *

State Fair Advertising

At the Wisconsin State Fair early in September, the Christoffel Concrete Products Co., members of the Wisconsin Concrete Products Association, had on display a concrete wall, showing a typical section of concrete block wall, including the portland cement stucco on the outside, with furring and plaster on the inside. There were also several pieces of garden furniture on display for which considerable advertising was done by giving visitors chances on a flower vase. Each visitor wanting a chance on the vase, filled out a blank with name and address, and indicated whether or not he was interested in a concrete house or garage.

Organization Complete for Cement Research

Studies of the constitution of portland cement which have been made for a number of years by the United States Bureau of Standards, under the direction of Dr. P. H. Bates, are being continued and extended under a cooperative arrangement with the Portland Cement Association.

For some time the Portland Cement Association has been making plans for a thorough study of the physicochemical properties of portland cement, of the raw materials from which it is manufactured, and of the products into which it is converted when used in concrete, and a year and a half ago the Bureau of Standards, Washington, extended an invitation to the Portland Cement Association to carry on this work on the constitution of portland cement as a cooperative investigation. Time has been required in assembling men with the necessary qualifications and experience for carrying out this work. After painstaking effort, however, a competent staff has been recruited and is at work under the Portland Cement Fellowship at the Bureau.

The entire investigation is under the general direction of Dr. Bates and Professor D. A. Abrams, of the Structural Materials Research Laboratory, Lewis Institute, Chicago. In addition to Dr. Bates, the Bureau of Standards has supplied full time of two men and part time of others, as required for analytical purposes. Dr. R. H. Bogue, formerly Associate Professor of Chemistry at Lafayette College, Easton, Pa., is in charge of the work for the Association. Dr. Bogue is editor of a book on *The Theory and Application of Colloidal Behavior*, recently published by the McGraw-Hill Publishing Co. Other representatives supplied by the Association are: Dr. W. C. Hansen, associate chemist; F. W. Ashton, petrographer; Wm. Lerch and L. T. Brownmiller, analytical chemists. P. V. Wells, physico-chemist, experienced in the work of the Bureau, is one of the Bureau of Standards' representatives, and is devoting special attention to the investigations of hydration.

The initial investigations include:

(1) A study of cement clinkers made from pure compounds and from pure compounds with admixtures of the impurities found in natural materials.

(2) Petrographic studies to determine the optical characteristics of cement mineral constitutents and the quantitative petrographic analysis of clinker.

(3) A study of the hydration of cement in all its phases.

(4) The crystalloidal behavior of silicic acid.

Further studies will be undertaken as their desirability is developed from the investigations now under way. To date, considerable time has been devoted to the development, construction, and standardization of equipment and to the study of methods of test best suited for the work. The staff is now actively engaged on work along the lines outlined above.

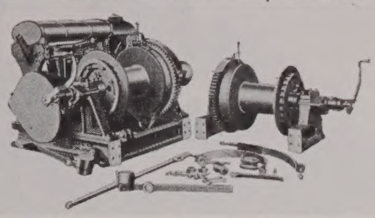
* * *

Highway Transportation Costs

Highway Transportation Costs by T. R. Agg and H. S. Carter is issued as bulletin No. 69 of the Iowa State College engineering experiment station. In its 32 pages and cover is presented a study of highway transportation costs as affected by the various vehicule operation costs, rolling resistance (relation between road type, fuel consumption, general operating costs). Most of the projects involved in the study were carried out in cooperation with the Bureau of Public Roads, U. S. Department of Agriculture.

Flory Hoist With Fordson Gasoline Motor

The accompanying illustration shows the new Flory gasoline hoist of the S. Flory Mfg. Co., Allentown, Pa. This equipment is recommended for rapid handling of material, and is described as a Flory hoist with a Fordson gasoline motor, a combination designed for use by contractors, quarrymen, and others who have hoist requirements. Points of advantage claimed for this new hoist are: minimum amount of space occupied by it and its light weight compared with the duty performed. The parts of the hoist are standard Flory make, and the motor parts can be secured at the nearest Ford service station.



Flory Hoist with Fordson Motor

New O. D. G. Steel Shore Uses Old and New Timbers

Use of shoring timbers, old or new, that the contractor or builder already has, is a big economy effected by a new building shore just marketed by the O. D. G. Co., of Owensboro, Ky. The O. D. G. Co. is a sales department of the Owensboro Ditcher & Grader Co.

The O. D. G. adjustable combination square shore consists of two steel channels, 5 ft. long, riveted together, with solid steel foot plate, steel cross ties, and steel head plates, forming a strong container within which the 4x4 or other timber is placed, adjustable in height at pleasure. 3½x3½ timbers can be used, or two 2x4's can be spiked together. It is asserted that the new O. D. G. increases the life of the timbers 50 usings or more.

Two sides of the container are solid, the other two have open channels 1 in. wide almost the entire height. These open channels permit nailing bracing to the timber contained within the body. Bracing may be attached to any part of the timber above the shore. This is an exclusive feature of the O. D. G., and one greatly appreciated by workmen.

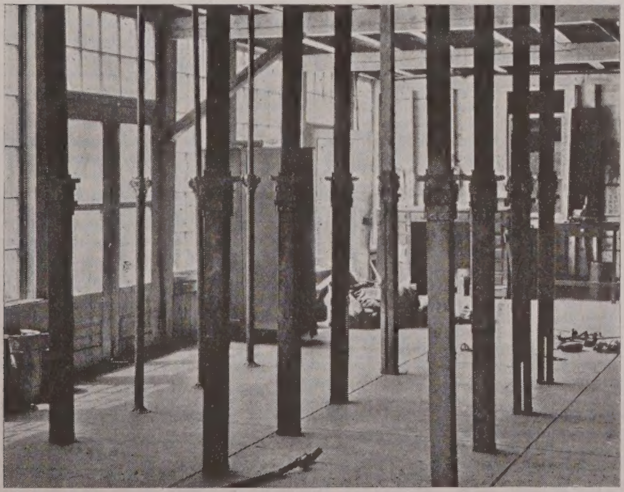


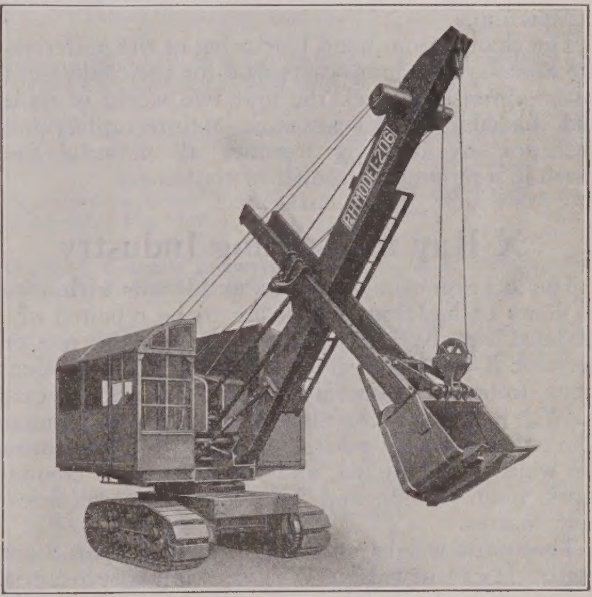
Fig. 1—O. D. G. Steel Shores in Use

The shore is easily operated by unskilled labor. Setting up, adjusting, taking down, resetting is a one-man job of few moments. There are no wedges, no loose parts, no guess work in grading, no expensive "scabbing" of timbers.

Priced at less than $5, it is asserted that this is the lowest-priced steel shore on the market. The O. D. G. Co. also announces adjustable round and square column clamps, round all-metal shores, and a full line for every purpose.

P & H Excavator Equipped With Cab

The Pawling and Harnischfeger Co. is now equipping all of its ½-yd. and ¾-yd. capacity excavators with a specially designed all-steel cab, which not only gives the machine neatness of appearance, but fully assures the complete protection of all the main machinery against inclement weather and tampering. This cab is provided with windows on each side of the operator, so that he may be fully protected from the cold or dampness and efficiently operate the machine at the same time. A swinging steel door is placed at each side of the machine to give complete access to all parts of the machinery. These two doors are provided with latches and may be locked. The windows are protected by sheet steel covers, which may easily be slipped into place when the machine is not being used. A rolled sheet cover is placed over the drums and gears, with a narrow slot for the cables to lead through, which eliminates the heavy door which was formerly used and also gives a better protection.



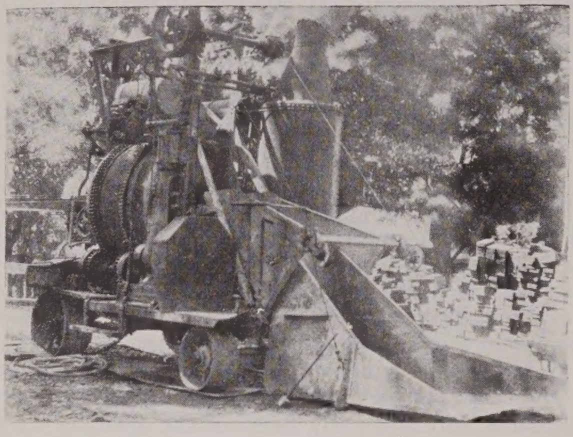
Excavator Equipped with All-Steel Cab

Another new feature that is now being used on all P&H Model 206 machines is the ¾-yd. struck measure dipper. The use of this dipper will substantially increase the output of this machine.

This Model 206 has new, increased capacity ratings in accordance with increased dipper capacity. These ratings are all based on 75% of the overturning load, which gives a wide margin of safety.

Increasing Mixer Capacity

When the barrow men on Michael Allzone's paving gang in New Jersey went out on strike, he lost little time replacing the strikers with two-wheeled carts and unorganized quadrupeds. That change meant two more men for the mixer crew to help keep the dump-carts' load within the narrow confines of the hopper sides—so Mike added a flaring apron wide enough to accomodate standard tread cart wheels and fired the two men.



Mixer with Extended Hopper

The extended hopper apron served admirably for handling stone and sand from the carts, but interfered with the stack on the mixer boiler. For a day or two the boiler was run without a stack, but its performance was so unsatisfactory that a special stack with a double offset was built and bolted in place. It gave the required draft, cleared the apron in the dumping position and, as Mike observed, "ye don't look f'r beauty in a concrete mixer" so it gave entire satisfaction.

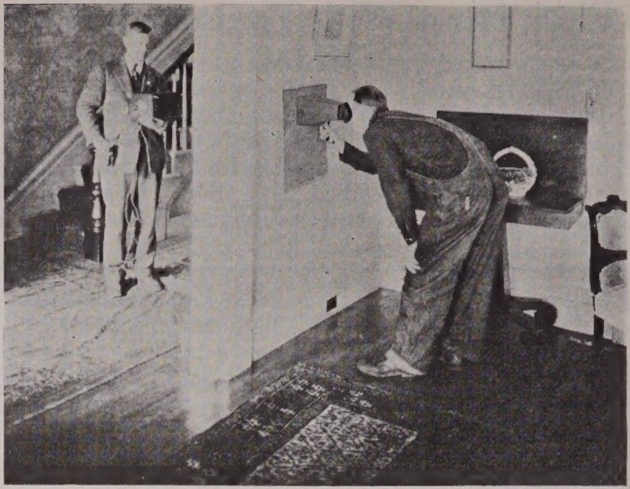
The change from hand barrowing of the materials to the horse-drawn dump-carts paid for the change in the mixer apron and stack the first two weeks of its use, and likewise permitted more uninterrupted mixer operation by bringing together all material for a batch in a minimum number of containers.

X-Ray in Building Industry

The location of pipes, wires, and beams within walls or floors of buildings which are to be repaired or remodeled can be easily determined by the use of a portable X-ray outfit which, according to an announcement from the General Electric Co., Schenectady, N. Y., has just been developed by that company. The outfit makes it possible to see within and through the walls, it is claimed, and the location of elbows in pipes, main rafters, and wire connections becomes an easy matter.

The outfit weighs only 20 lb. and occupies a small space. It can be carried with ease and is substantially constructed. It is claimed that the outfit is especially well adapted for numerous lines of physical investigation work and for special uses in the trades.

To use the new apparatus, it is merely necessary to connect an ordinary extension cord in the nearest socket of the house circuit. X-rays are then produced merely by pressing the switch. Since the outfit is totally encased in a metal container, which, in turn, is within a leather-covered, wooden carrying case, there is no high voltage hazard. The outfit is grounded to the container.



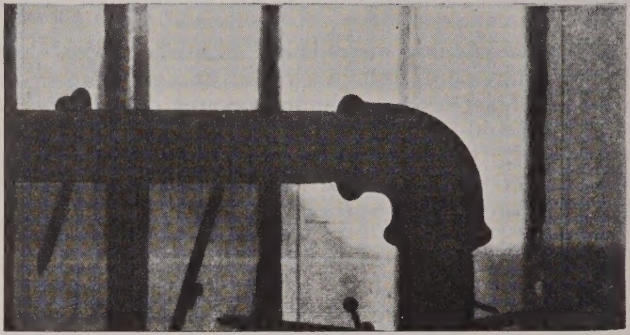


Fig. 1—Use of Portable X-ray Equipment, with Fluoroscope and Protective Screen, by two Men to Locate Pipes and Wires Within a Wall

Fig. 2—X-ray View of Wall, Revealing Elbow in Pipe, and Nails

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Concrete, published monthly at Detroit, Michigan for October, 1924.

State of Michigan, }
County of Wayne, } ss.

Before me, a Notary Public, in and for the State and County aforesaid, personally appeared R. Marshall, who, having been duly sworn according to law, deposes and says that he is the General Manager of Concrete, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse side of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Concrete-Cement Age Publ. Co., Detroit, Mich.
President—R. Marshall, Detroit, Mich.
Managing Editor—Harvey Whipple, Detroit, Mich.
General Manager—R. Marshall, Detroit, Mich.

2. That the owners are (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock):

Concrete-Cement Age Pub. Co., 1807 E. Grand Blvd., Detroit, Mich.
R. Marshall, 1807 E. Grand Blvd., Detroit, Mich.
Harvey Whipple, 1807 E. Grand Blvd., Detroit, Mich.
F. F. Lincoln, Room 1710, 115 Broadway, New York City.
R. N. Jackson, 1807 E. Grand Blvd., Detroit, Mich.
R. W. Lesley, Pennsylvania Bldg., Philadelphia, Pa.
Edward B. Bruce, Manila, P. I.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above ,giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholders or security holders appear upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers, during the six months preceding the date shown above is———. (This information is required from daily publications only.)

R. MARSHALL,
Manager.

Sworn to and subscribed to before me this 28th day of Sept., 1924.

(Seal.) PERSIS E. HILL.

(My commission expires August 10, 1928.)

New Books

A Hundred Years of Portland Cement, by A. C. Davis, M.Inst.C.E.I., M.I.Mech., F.C.S. XXII. 282 pp.; 41 illus. London: Concrete Publications, Ltd. Price: Cloth binding, 21*s*.; leather, 25*s*.)

This volume has been specially written to mark the centenary of the invention of portland cement in 1824. In addition to a complete history of the growth of the cement industry from the early days until it has arrived at its present position as one of the most important industries in the world, a mass of information is given on the different methods of manufacture during the period under review. The value to the consumer of the improved methods of manufacture in modern cement works is shown by the fact that whereas in 1852, the tensile strength of the neat portland cement on the market was only 100 lb. tensile per sq. in. at 7 days, present-day cement has a strength of 750 lb. per sq. in at the same period. The statement so often made that Joseph Aspdin, a bricklayer of Leeds, was the inventor of portland cement, as we know it today, is not accepted by the author, whose researches have led him to the conclusion that Aspdin was the inventor of the name "portland cement" only, and that similar cements were made earlier than the date of Aspdin's patent (1824) by Vicat in France and Frost in England.

The volume contains a summary of the portland cement specifications of the world, and a great deal of information which should be of value to all architects, engineers, and builders who take an interest in the materials they use, and also to chemists and geologists. An appendix gives in full the early patent specifications for portland cement by Higgins, Parker, Frost, Crampton, Ransome, Stokes, Hurry, and Aspdin. The volume is well bound, and has been produced in an attractive manner suitable to the important event it commemorates.

Compendium of Building Data for Architects, Engineers, and Builders, by J. Soman. Size, 8 in. x 11 in.; 18 pp.; paper covers. Price, $1.00. The Jual Publishing Co., New York City.

This book is designed for the use of all those engaged in building business who design, estimate, or build. The designing charts and estimating data are an attempt to combine, under one cover, most of the information which the architect and builder is called upon to answer in connection with design and cost of composite building construction, with a minimum of tedious calculations.

The information contained is based upon the New York Building Code, and cost data for approximate estimating is presented, square foot cost being based on New York prices for the winter of 1923.

Henley's Twentieth Century Book of Recipes, Formulas, and Processes, edited by Gardner S. Hiscox. Size, 6 in. x 9 in.; 806 pp.; cloth binding. Price, $4.00 per copy. Norman W. Henley Publishing Co., New York City.

This book contains 10,000 selected household, workshop, and scientific formulae, trade secrets, chemical recipes, processes and money-saving ideas, and is recommended as a valuable reference book for home, factory, office, and workshop. It is a revised and enlarged edition, in which the following subjects are a few of those treated: Acid-proofing, alloys, water purification, anti-frost solutions, cements, rust preventives, polishes, ceramics, fireproof and waterproof paints, lubricants, paints, varnishes, etc.

National Association of Cost Accountants 1923, by the National Association of Cost Accountants. Size, 6 in. x 9 in.; 378 pp. Issued at 130-42nd St., New York City.

In addition to being the year book for 1923, this volume contains the *Proceedings* of the Fourth International Cost Conference at the Statler Hotel, Buffalo, N. Y., September 10-13, 1923. Discussions are included of the various subjects covered at the convention, including methods of wage payment as related to cost; to what extent and in what manner should detail cost figures be given to department heads; actual examples of the advantageous use of operating budgets; and how far is it proper for a trade association to distribute cost information among its members.

On the subject of trade associations, the discussion does not take up the general question as to the legality of such activities on the part of trade associations, but presents some data as to the actual practice of trade associations which are at the present time engaged in exchanging statistical information within the limits of the law so far as it has been definitely defined.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 1807 East Grand Boulevard, Detroit, Convention, Chicago, February 24-27, 1925.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago.

American Engineering Standards Commission; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth Street, New York City.

Associated General Contractors of America; G. W. Buchholz, Secretary, 1038 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 W. Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Rudolph P. Miller, President, Fred W. Lumis, City Hall, Springfield, Mass., Secretary.

Iowa Cement Stave Silo Association; H. E. Kilmer, Secretary, Oskaloosa, Ia.

Iowa Concrete Products Association; Ross Dowell, Secretary, 405 Hubbell Bldg., Des Moines.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

National Association of Manufacturers; John E. Edgerton, President; Henry Abbott, Treasurer; George S. Boudinot, Secretary, 50 Church St., New York City.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High Street, Columbus, Ohio.

The National Concrete Stave Silo Association; W. G. Kaiser, Secretary, 111 West Washington St., Chicago.

National Crushed Stone Association; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East 22nd St., New York City.

The National Lime Association; Mather Bldg., Washington, D. C.

National Sand and Gravel Producers' Association; T. R. Borrows, Acting Secretary, 903 Munsey Bldg., Washington, D. C.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington Street, Chicago.

Wisconsin Concrete Products Association; D. R. Collins, Secretary-Treasurer, Milwaukee.

Trade Publications

100 Years is the title of a brochure issued by the Marquette Cement Manufacturing Co., "Commemorating the centennial of portland cement, and the 25th year of Marquette." It tells the story in both text and pictures in as attractive and thoroughly interesting a way as any piece of similar literature received. It is the work of Bertrand C. Wheeler, and as the historian of a special industry he displays a fine appreciation of the value of words.

Waterproofing Methods and Materials, Karnak Bulletin No. 6, Gardiner & Lewis, Inc., 5 North La Salle Street, Chicago. This is a 32-page letter size book very attractively printed in both cover and contents, telling kind, methods and specifications for waterproofing. The object of the book is stated to be to place before intelligent readers thoroughly authenticated facts and data on bituminous materials, so that they may exercise proper discrimination in writing waterproofing specifications for such materials.

Godwin Steel Paving Guards for the elimination of edge wear and disintegration, is the subject matter of a circular of W. S. Godwin Co., Inc., Race & McComas Streets, Baltimore, Maryland, under the title "*2½% for Permanency*."

The 7-S Mixer Book (Leach Co., Oshkosh, Wis.) presents reports of inspections made by the Robert W. Hunt Co., testing engineers, of the performance of mixers competing with the Leach machines. Among the subjects under observation were mixing, loading and discharge time.

Con-O-Lite Burial Vaults makes the subject matter of a catlog issued by the National Casket Co., Albany, Buffalo, Oneida, Rochester, Scranton and Syracuse. Con-O-Lite is a trade name given to concrete of light weight using a special aggregate to which attention has already been called in these pages.

Colormix to which attention has already been called in these pages, is the subject matter of an architects' handbook issued by the Master Builders Co., Cleveland, Ohio. It tells how to use Colormix for both plain and tile patterned concrete floors, as a concrete hardner, waterproofer and dust-proofer in several permanent colors.

Novocrete is the title of a pamphlet issued by the Novocrete Co., 522 Fifth Ave., New York City, describing a kind of concrete made with mineralized sawdust as an aggregate, and calling attention to its special qualities and characteristics. The pamphlet directs attention to the fact that this material is "better than concrete for many purposes." A summarization of tests has already been published in these pages.

Austin Leaning Wheel Graders are described in a new catalog issued by the Austin Manufacturing Co., Chicago. It is a fine piece of printing and representation in halftone and drawing of the construction and use of the leaning wheel graders in the Austin line, as sold by the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

The Austin Motor Grader, is an 8-page, two color bulletin issued by the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, describing the equipment made by the Austin Manufacturing Co., Chicago.

A pamphlet describing the foundry of the Studebaker Corporation, *An Achievement in Modern Foundry Construction*, is issued by the Truscon Steel Co. It describes in text and pictures how various problems of lighting and ventilation were solved with Truscon steel sash and includes methods of design of equipment, for day lighting and natural ventilation.

The *Everhot branding outfit*, which may also be used as a soldering iron if desired, burns gasoline and is offered as a handy tool with which to brand the handles of shovels, picks, wheelbarrows, scaffolding, planks, and various other materials and equipment for both contractors and others whose possession should be marked to avoid loss by theft. The equipment is made by the Everhot Manufacturing Co., Maywood, Ill.

Boca Solid Steel Sash, catalog F-24 of the Bogert & Carlough Co., Paterson, N. J., is attractively gotten up, printed on good paper to show this kind of sash in every detail of construction and use—the various sizes which are available, the methods of installation in different types of construction, and for various purposes.

How to Cure Concrete is the title of a booklet issued by the Dow Chemical Co., Midland, Mich. It is offered as a manual of instruction on curing concrete pavements. It shows in text and illustrations how to use calcium chloride in curing concrete, and the effect; and contains a reference section with specifications for the correct application of this method of curing which is offered as an improvement upon and substitute for sprinkling and ponding.

Specifications for *Koehring Heavy Duty Construction Mixer No. 21S* are given in a new publication issued by the Koehring Co., Milwaukee, Wis., with numerous illustrations of the machinery at work on the job, and detailed use of the various parts of the equipment. It is a specification book in detail in both text and illustrations and winds up with a table of proportions and quantities.

Mortar colors and their various effects in brick wall construction are very attractively shown in a circular issued by the Ricketson Mineral Paint Works, Milwaukee, Wis. The circular not only shows five samples of brick wall in various colors, but it gives considerable information as to the use of motrar colors in obtaining different tints.

Hydrated Lime Makes Concrete More Workable is the title of bulletin 311, issued by the National Lime Association, Washington, D. C. In this bulletin, it is cited that everyone who specifies or uses concrete is interested in workability. The man who specifies or the engineer who designs is primarily interested in securing a uniform homogeneous concrete of sufficient strength to meet his design. Along this line, it is cited that the workability of ordinary concrete can be improved and the safest and most economical method of securing this desired feature is by adding hydrated lime to the mix. References are made to an American Concrete Institute paper entitled *Economic Value of Admixture* by J. C. Pearson and extracts from the paper are included.

Among the other points touched upon are: Saving Due to Admixtures; Admixtures vs. More Cement; Early Use of Admixture; Effect on Strength; Value Best Seen in Field, and Recommendations for Use.

In producing the fourth edition of *Science and Practice of Integral Waterproofing*, which is just off the press, the Truscon Laboratories, Detroit, Mich., have made a number of changes in the booklet in the interest of simplification. The first 15 pages take up the study of the porosity of concrete and cement mortar—why concrete should be porous and how the pores in concrete act to absorb moisture. The subject is then developed showing how this moisture absorption can be stopped by the use of a repellent waterproofing compound.

The latter section of the pamphlet is devoted to specifications: waterproofing mass concrete—waterproofing mass concrete and masonry by the cement plaster coat method, and the production of waterproof cement stucco and mortar.

Of special value is the concluding chapter, as it takes up the practical application of a cement plaster coat, calling attention to certain little precautions which, if followed, avoid failure of plaster coat or stucco.

Copy of this new edition will be sent to persons interested by addressing The Truscon Laboratories, Detroit, Mich.

The Truscon Laboratories have just issued a very valuable book on painting, varnishing, enamelling, etc. The book is compiled strictly from the maintenance point of view and is entitled *Truscon Maintenance Data Book*. It consists of approximately 100 pages, 8½ in. x 11 in., fully illustrated with maintenance charts, color charts, photographs and other illustrations.

Because of the completeness and the great cost of producing it, the book is not issued for general free distribution. The price is $3.00 per copy.

100 and 1 Ways to Save Money with Portable Air Power is the title of a new 72-page book issued by the Ingersoll-Rand Co. containing a complete and up to date description of portable air compressors and the many air tools and labor aiding methods made possible by them, including many new applications not previously illustrated or described. Wherever possible, cost data comparing hand versus machine methods are given. There are over 100 illustrations showing various applications.

This book is of interest to practically every industry, showing portable compressor uses by public service companies, municipalities, general contractors, road builders, in building construction and repair, on railways, steam and electric, in factories, etc. It describes the use of paving breaker, jackhammer, rock drill, trench and clay digger, backfill tamper, Little Tugger hoist, tie tamper, pneumatic drill, riveter, calking hammer, drill steel sharpener, sand blast, paint spray, cement gun, etc. Copies of this book may be obtained from the head office at 11 Broadway, New York or from any of the branch offices.

An interesting publication has been issued recently entitled *Better Street Lighting with Greater Safety*. This describes the Kuhlman series multiple street lighting systems, and can be obtained by writing the Kuhlman Electric Co. at Bay City, Mich. The Kuhlman Electric Co. is the originator of the series-multiple transformer and much instructive data is incorporated in this book.

The Owensboro Ditcher and Grader Co., Owensboro, Ky., has just issued a 12-page catalog, 8 in. x 10½ in. descriptive of the O. D. G. adjustable combination shores, column clamps and construction appliances. The catalog has illustrations showing the construction of the shores and clamps, and with general views showing the adjustable combination square and all metal ground shores in use under various conditions.

The S. Flory Manufacturing Co., Bangor, Pa., has just issued a broadside entitled *Flory Gasoline Hoist* picturing and describing a standard Flory hoist with a Fordson gasoline motor. This new Flory gasoline hoist is described as a double drum, gasoline hoist having 4000 lb. load capacity at 125 ft. per minute. Complete specifications are included.